CEREAL SCIENCE today

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MARCH 1961 • VOL. 6 • NO. 3 • 35c COPY

AN OFFICIAL PUBLICATION OF THE AMERICAN ASSOCIATION OF CEREAL CHEMISTS

OF INTEREST THIS MONTH

PEELING OF WHEAT KERNELS
AACC'S OSBORNE MEDALIST
DETECTING FUNGICIDES ON GRAIN
PREDICTING ROPINESS IN BREAD

UTAH STATE AGRICULTURAL COLLEGE
MAR 8 1961
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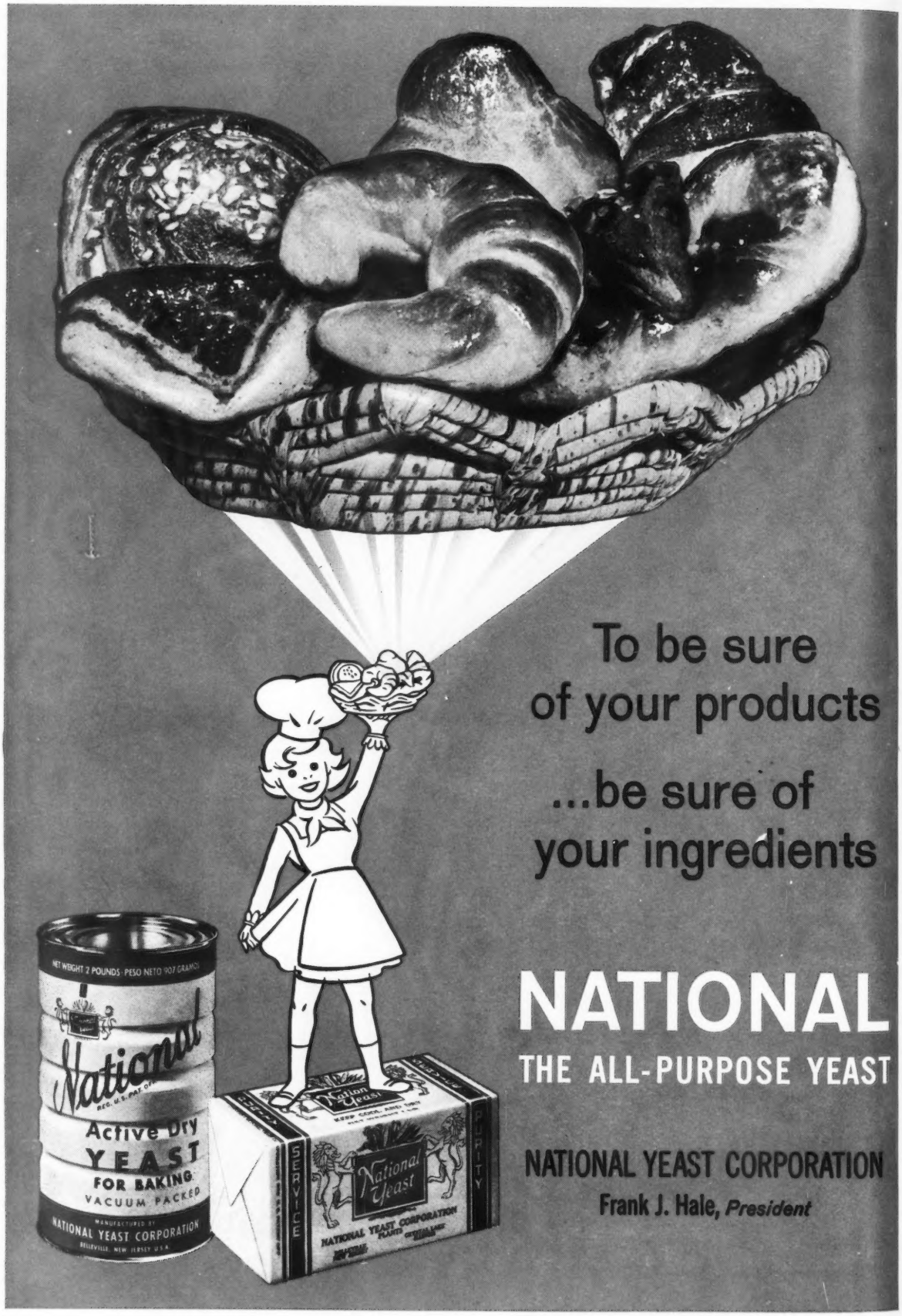
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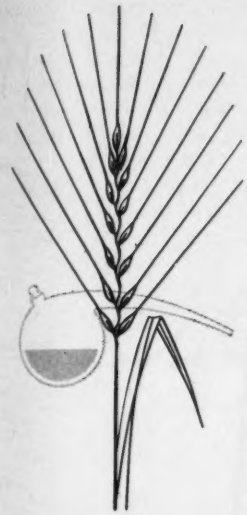

FEATURES

AACC's 1961 Osborne Medalist	74
"Peeling" of Wheat Kernels. Y. Pomeranz	76
AACC's 46th Annual Meeting	80
Method for Detecting Fungicides on Grain. S. Molinas	84
A Rapid Bacteriological Method for Predicting Ropiness in Bread. J. J. Russ, Wendell Reeder, and D. W. Hatch	89
Chemical Warfare	102

COVER: Dr. Majel M. MacMasters, recipient Thomas Burr Osborne Medal

CEREAL SCIENCE today

MARCH 1961 VOLUME 6 NUMBER 3

DEPARTMENTS

Editorial	73
People, Products, Patter	92
Feed Technology	97
AACC Local Sections	98
Starch and Starch Products	99
President's Corner	100
Book Reviews	101

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CEREAL SCIENCE Today is published ten times per year (monthly except June and August) by the American Association of Cereal Chemists, from 500 South 5th Street, Minneapolis 15, Minnesota. Editorial, Circulation and Advertising Headquarters: 1955 University Avenue, St. Paul 4, Minnesota. Second class postage paid at Minneapolis, Minnesota.

The American Association of Cereal Chemists assumes no responsibility for the statements and opinions advanced by contributors to its publications. Views expressed in the editorials are those of the editors and do not necessarily represent the official position of the American Association of Cereal Chemists.

Subscription rates: 1 year, $3.00; 2 years, $5.00; 3 years, $7.00. Foreign postage: $1.00 per year extra. Back issues available on request. Single copies: 35 cents.

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editorial

DR. MAJEL M. MACMASTERS has been selected as the eleventh recipient of the Thomas Burr Osborne medal, named for the famous protein chemist to whom it was awarded in 1928.

It is fitting and important that scientific societies give such recognition to outstanding achievement. Rewards for distinguished accomplishment are often thought to provide an incentive to others. Actually, we doubt whether any Osborne medalist ever did his work for the sake of being thus recognized. It is not an honor sought in open competition. Dr. MacMasters' modesty is such that it was difficult for her to believe the news of her selection.

With great emphasis today on "team" effort and with major expenditures being made for the "hardware" to equip laboratories, it is important that we be reminded that advances in scientific knowledge begin with an idea that unfolds in some mysterious manner within the mind of an individual human being. Such an idea may suggest a hitherto unsuspected relationship between observed phenomena, or it may open new vistas to human observation by suggesting techniques by which new and meaningful measurements may be made. One idea may stimulate another, but each is the product of an individual. All else in science consists of merely checking the validity of ideas or extending their applications.

It is significant that the American Association of Cereal Chemists' Osborne Medal continues to draw attention to the unique contributions that outstanding individual scientists have made to the field of cereal chemistry.

P.E.R.

Dr. Majel M. MacMasters, eleventh recipient of the Thomas Burr Osborne Medal Award. The award will be presented at the AAAS meeting in Dallas.

"For Distinguished Contributions in Cereal Chemistry"

1961

THE AMERICAN ASSOCIATION of Cereal Chemist will award its highest honor, the Thomas Burr Osborne Medal, to Dr. Majel M. MacMasters, Department of Flour and Feed Milling Industries, Kansas State University, Manhattan, Kansas, during the Association's 46th Annual Meeting, April 9-13, at Dallas, Texas.

The award was founded by the AACC in 1926 to recognize "Distinguished contributions in the field of cereal chemistry," and was named after the oustanding protein chemist, Thomas Burr Osborne. The medal has been awarded only ten times previously during the 35 years of its existence. Other winners have been:

1928 Thomas Burr Osborne
1932 Clyde H. Bailey
1936 Morris J. Blish
1938 Charles O. Swanson
1942 Ross Aiken Gortner
1945 John C. Baker
1948 Betty Sullivan
1950 William F. Geddes
1954 Rudolph M. Sandstedt
1957 J. Ansel Anderson

Early Education

Dr. MacMasters' interest in chemistry was evoked early, with three years of courses in high school, including quantitative analysis. She had no hesitation in selecting chemistry for her college major, choosing what is now the University of Massachusetts (then Massachusetts State College) because of its high reputation in this subject. For the M.Sc. degree (Massachusetts State) in 1928, having minored in botany, she wrote on the solubility of iron in plant nutrient solutions. Her Ph.D. degree, obtained in 1934 from the same institution, was on "Rhythmic crystallization of potassium dichromate from aqueous solutions."

Teaching positions in chemistry occupied several of the post-college years. Beginning at Massachusetts State the year of taking the B.Sc., she was half-time assistant, 1926-28, and full-time, 1928-29. During the latter year she exceeded her specified duties — having charge of all general chemistry laboratories — and taught courses in inorganic and analytical chemistry for a professor on sick leave.

A year at Lindenwood College followed, in which Dr. MacMasters, as Instructor, taught courses in chemistry and biochemistry. Then in 1932 an available assistantship and other financial advantages, especially important in the early Depression period, took her back to the Massachusetts college for work toward the Ph.D. degree, which was conferred there in 1934.

Research Career Begins

After another year the Middle West beckoned, with abundant opportunity for research, and Dr. MacMasters' career in cereal chemistry had its real beginning at the Illinois Agricultural Experiment Station, Urbana. As Research Assistant to Research Instructor (1935-40), she did research on microscopy and the physical characteristics of corn and wheat starches. To a lesser degree, she did work on hemicelluloses of soybeans and cereal grains.

In 1940 a period began during which the AACC's medalist reached her present distinguished status and made major contributions in microscopic investigations of cereal grains, particularly in the field of forages and starch derivatives of these grains. Her position was Associate Chemist to the Head of Cereal Microscopy and Quality Investigations, at the USDA's Northern Utilization Research and Development Division, Peoria, Illinois.

Here Dr. MacMasters' research

THOMAS BURR OSBORNE MEDAL
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FOR DISTINGUISHED CONTRIBUTIONS IN CEREAL CHEMISTRY

The Thomas Burr Osborne Medal — a gold medallion presented by the American Association of Cereal Chemists to distinguished scientists in the field of cereal chemistry. The relief is a portrait presentation of Thomas Burr Osborne, a renowned protein chemist.

included work on the structure of cereal grains in relation to processing; microscopy and physical characteristics of starches, and special phases of processing of cereal grains. She co-operated with plant breeders in a number of important developments. Among these were: high-yielding waxy corn and high-amylose corn for industrial starch production; waxy sorghum (during World War II), which gave a white starch for commercial use; starch sponge, now in use as a hemostatic agent; and a practical method of separating corn hull hemicelluloses for use as thickeners and stabilizers.

Present and Projected Work

The year 1960 marked a conclusion to her work for the USDA at Peoria and the beginning of a new phase of her career, teaching and research at Kansas State University's Department of Flour and Feed Milling Industries. There, her research centers on starchy endosperm cell walls in wheat. One study seeks to determine whether the composition of these cell walls in hard wheats is related to varietal differences in their milling quality. In work done several years ago with others, on seven varieties of Pacific Northwest wheats, a correlation was found between these two characteristics. Information gained by this study will be important in helping wheat growers choose the most advantageous varieties to plant, and to millers in producing the best quality of flour from them.

Work is also being initiated at KSU on the effects of conditioning of wheat — i.e., changing and controlling its moisture content to suit the need and purpose of milling or other use. This investigation will involve several methods of conditioning and their effects, in several varieties of wheat. Since cell walls must be broken to produce flour particles, Dr. MacMasters reasons that one function of proper conditioning is to modify the physical properties of the cell walls in such a way as to facilitate this breakage.

Both these current studies, Dr. MacMasters feels, should contribute to a better basic understanding of the scientific principles of flour milling. Additional work will be closely related to problems of processing of cereal grains, and to the quality of milled products for specific uses. These lines of research will be established in the near future.

Probably because she has the broadest experience in these two fields, Dr. MacMasters' greatest interest is divided between the development of the scientific foundations of the processing of cereal grains, and elucidation of factors controlling the colloidal properties of starches.

AACC Writings and Services

During the years at Peoria and earlier, Dr. MacMasters' contributions to *Cereal Chemistry* and other scientific journals, usually as co-author with one or more colleagues at Northern Utilization laboratories, have been numerous and distinguished. Outstanding among these contributions was an extensive literature review on wheat conditioning, published last year. This book, "Conditioning Wheat for Milling," surveyed the literature through October 1958, bringing together in convenient form detailed summaries of a wide variety of conditioning procedures, both successful and unsuccessful, for the guidance of workers in this comparatively new field.

Services to the AACC have been continuous since 1947, with membership on hard-working committees, all of them current, in addition to a previous term on the Monograph Committee. She was a member of the Editorial Board of CEREAL CHEMISTRY for eight years, and now is chairman of the committee working on revision of *Cereal Laboratory Methods* (7th edition).

Personal Pursuits

When questioned about hobbies, Dr. MacMasters tells about the few that she has time for, mentioning foreign languages — other than those in which she had formal training, the hardest of all subjects for her. Preparation of the survey on conditioning forced her to read the unfamiliar languages, and she belatedly and to her own surprise developed a considerable interest in them.

Personal pursuits are not easily sandwiched into a life so deeply involved in scientific research. A herbarium that was started in college and kept up for some years lost out to work, for lack of time, and was given away recently. Stamps are collected, but chiefly just to be stored away. Fishing is enjoyed, possibly because she sees in it such an excellent excuse for sitting still in a boat and doing nothing. If any fish are caught, they are a bonus. Vacations, including fishing, are often spent by Dr. MacMasters and her mother at their place on Lake of the Ozarks, Camdenton, Missouri. At home, music, chiefly classical and folk music from other countries, and books provide much of her relaxation. "Outside activities" at present are getting her new office and laboratory organized, and the "project" of a new house.

The Problems Involved in

"Peeling" of Wheat Kernels

By Y. Pomeranz

Department of Flour and Feed Milling Industries
Kansas State University, Manhattan

ONLY TWO BASIC steps in the milling process are devoted to flour manufacture: Separation of bran and germ from starchy endosperm and reduction of the latter to flour. The layman is often astonished to learn that to carry out these seemingly simple processes such a large amount of machinery and such a long process are employed. It is not surprising, therefore, that from time to time one reads about some revolutionary peeling process capable of better and more efficient separation of the starchy endosperm from the outer layers. None of these processes has been more than moderately successful on even a pilot-plant scale. Generally, the procedures permit the removal of the outer skin only, whereas the aim is to achieve a separation between pure starchy endosperb, and bran (including aleurone) and germ. But even with regard to the pericarp or outer skin, only the portions easily reached are removed, and it has not yet been possible to peel the portion within the crease.

Notwithstanding the many unsuccessful attempts, the pursuit of methods for wheat peeling continues. The effort is stimulated by two factors: the conventional procedure, despite its complexity, results in a yield only seven-eighths of theoretical, and the flour obtained by current methods does not contain the more nutritious outer layers. This leads to the necessity of flour enrichment to restore some of the lost nutrients.

This review summarizes attempts made to prepare wheat flour from peeled wheat. Some of the possible approaches to the problem are also outlined.

The Problems Involved in Peeling

The endosperm constitutes 91 to 92% of the total weight of the wheat kernel (2), out of which the aleurone makes up 6 to 7% of the kernel weight. Since the aleurone is the innermost layer of bran, the content of starchy endosperm amounts to approximately 85% of the whole kernel.

Complete separation of starchy endosperm from other wheat layers is rendered difficult mainly by the oval shape and crease of the kernel, and by the absence of a natural line of cleavage between the aleurone layer (the outermost part of the endosperm) and the starchy endosperm. The projections of the aleurone cells into the starchy endosperm, the stepwise border line, and the absence of a structural differentiation therefore make the separation difficult. This has led Mohs (11) to believe that botanical considerations exclude the possibility of peeling and thus increasing extraction from 74 to 85%.

Wheat-peeling methods may be divided into dry and wet procedures. Additionally, a combination of the two methods and a differential treating of the wheat kernel with heat and moisture to enhance better separation between individual kernel parts should be mentioned.

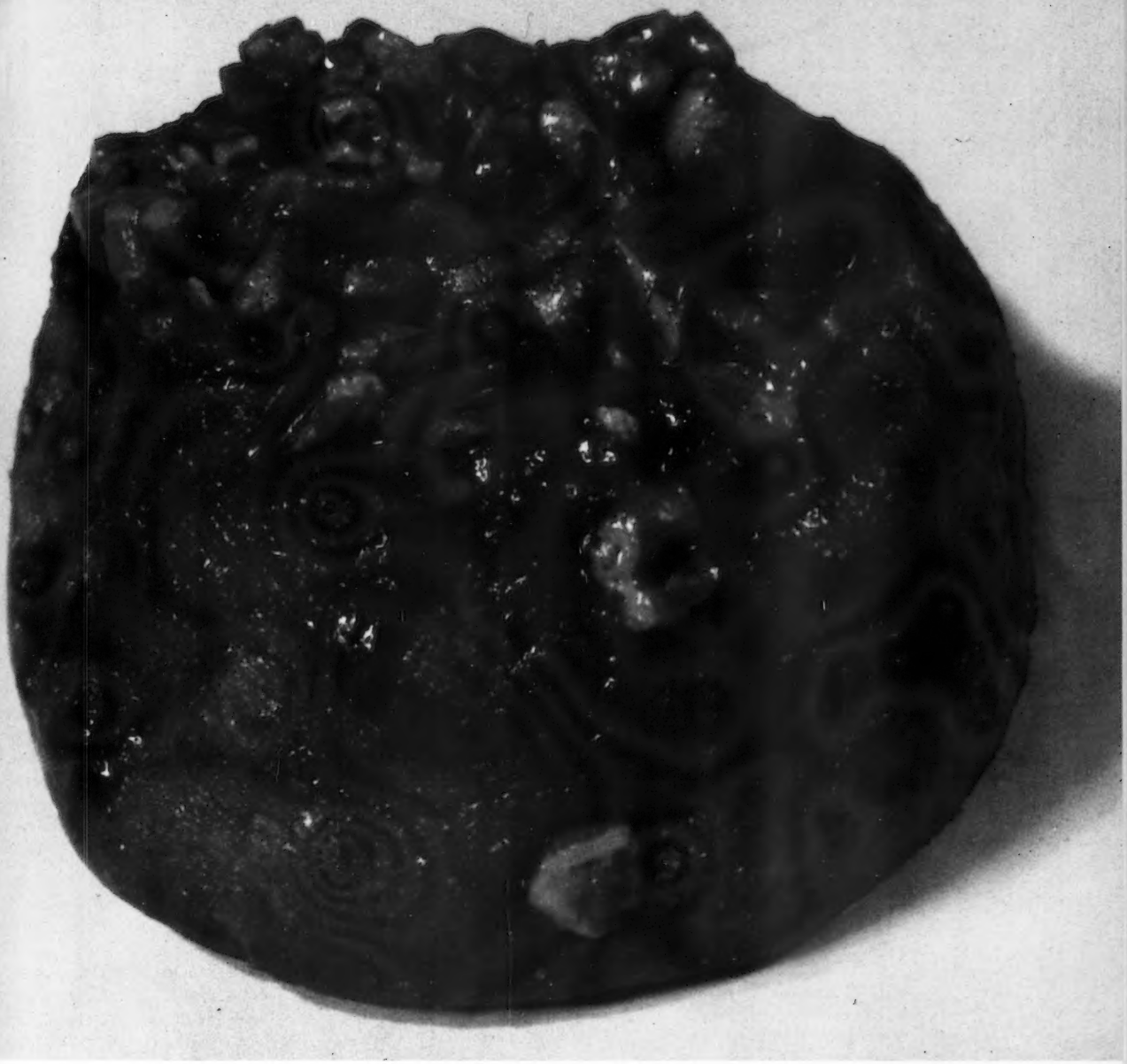
Dry Removal of Bran

A number of procedures for dry hulling of cereal grains other than wheat have been proposed. High-vitamin rice is being manufactured with the "Wemanco" huller, known in the U.S. as Moulsdale Brown Rubber Rice Sheller (19). Experiments to peel wheat on a simple rice huller were said to give satisfactory results (4) but actually removed the beeswing only. Further treatment to remove the remaining bran was unsuccessful and resulted in breakdown of the aleurone and of the whole kernel. It has been concluded (5) that the great loss of endosperm during abrasive or dry peeling techniques makes the practical application of these procedures doubtful.

In a novel procedure (9), material of vegetable origin is submitted to a rapid alternating of pressure in air or other gases. During the periods of vacuum, the material is disrupted mainly by pressure from within. This procedure has been employed to manufacture fine homogeneous powders, and has been proposed for preparation of whole-wheat-flour products. Its possible use in manufacture of high-extraction flours could be investigated.

Wetting of Wheat

Procedures to treat wheat by moistening with water and flowing the grain through an atmosphere of steam under pressure to remove the beeswing prior to milling date from the beginning of this century (21). According to Scheffer (14), such, and similar, procedures of steeping and mechanically removing bran leave the hyaline layer and layers under it unremoved; also the removal of some of the outer layers in the crease is impossible. Up to 4.5% can be removed by such peeling. Farmer (4) reviewed a number of such "peeling" methods. All were essentially based on mechanical loosening of skins on wetted wheat, and subsequent removal and separation of the skin. Only the beeswing was removed and the bran of the crease was not. The pretreatment had little, if any, effect on subsequent milling by conventional procedures.



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The Steinmetz procedure is one of the better-known methods for wheat peeling. Wheat prepared by this process is said to contain the aleurone layer intact, only the fibrous outer epidermis having been removed. The product obtained on milling of the treated wheat is a whole-wheat type. According to Mohs (11), the Steinmetz method has a number of shortcomings, comparable to those of similar procedures.

It is fitting to mention here studies on the effect of wetting on milling, conducted by Swanson (17), in which repeated wetting facilitated separation of bran from the endosperm; but the loosening of the bran coat had no significant effect on the yield of white flour.

All the above procedures are closely related to the numerous methods of conditioning employed in conventional milling processes. These have been reviewed extensively (3). It remains to be seen whether any of the novel conditioning procedures (such as using a high-frequency electrical field (16), or the treatment of evacuated grain with water to which various chemicals have been added (20), or subjecting grain to ultra short waves) will have a marked effect on separation of bran and germ from endosperm.

Chemical Treatment

A number of methods involving the use of various chemicals have been proposed. Treatment of grain with sulfate ion and peeling with a special machine have been claimed (8) to bring about satisfactory separation of the inner berry from the branny coat and to affect the aleurone layer in a way that aids bolting. In a process patented by Kranz (7), wheat is moistened to a water content of 16 to 17%. Materials with adhesive and cementing properties, as methyl or ethyl cellulose, and vegetable gums, such as gum arabic, or polyphosphates with viscous properties, are added to ensure controlled wetting of the grains. The washed grains are dried to 14% moisture and sprayed with a 2% aqueous solution of methyl cellulose until 16% moisture is achieved. The wet grain is then treated with formaldehyde to develop a film, maintained at a controlled temperature for about 1 hour, and then milled. By avoiding wetting of the endosperm and rendering the outer layers wet, the yield is said to be increased to 80-85%.

Heeren (6) proposed preparing wheat for debranning by treating the wheat with water containing an edible surface depressant, e.g. the dioctyl ester of sodium sulfosuccinate in quantities sufficient to lower the surface tension of the water to at least 50 dynes per cm., to effect selective moistening of the coats.

The above are taken from a long list of recommended chemical treatments. Some rather drastic methods, which could hardly be considered adequate to produce wholesome and acceptable bread, have been proposed. According to one procedure (12), better and cheaper bread can be produced by subjecting the kernel to 30% sulfuric acid or sodium hydroxide long enough to dissolve the husks. A patent for a similar, though milder, treatment has been issued more recently (18). Grain, extracted with a fat solvent to remove waxes and fats, is covered with dilute (0.25% of weight of grain) caustic soda solution for 4 hours. The grain is rinsed with water and the softened and loosened bran removed by action of a bristle brush revolving in an enclosed case.

Flotation Methods

Anderson (1) reported preparing peeled wheat by the following procedure. Dry grain was injected into a flotation unit which contained a small amount of sodium carbonate to assist in controlling the acidity, and a small amount of an oily substance to enhance air bubble formation, essential to flotation. The epidermis of the kernel was loosened and removed in adjacent flotation units. Rutledge (13), in his process of wheat peeling, also employed the principle of flotation. The peeler was comprised of rubber-lined tanks equipped with a rubber-covered impeller by which a grain-water slurry was agitated. An edible reagent was added to the slurry to form a froth, which collected husks as they broke away. The froth was skimmed off, and the wheat kernels, which dropped to the bottom, were transferred to a vibrating screen, then to a continuous centrifuge, and finally to a rotary drier. The analytical data given confirm a high nutritive value. But to judge from the ash content, the milled product contained the aleurone layer, and the high crude fiber content indicates rather poor removal of bran layers.

What About the Future?

Two extreme views on the prospects of wheat peeling are expressed by the following citations. According to a recent publication of a milling machinery manufacturer (10), the technical progress made with regard to machinery for conditioning and grinding processes is such that no more revolutionary changes or developments can be expected at the present time. But according to Scott (15), the day may come when some wet or solvent milling, intensified scouring or decorticating, kernel separation by a heat treatment, or "explosion" may be perfected which will render present milling processes obsolete virtually overnight.

In view of so many futile attempts, it seems rather unlikely that a dry scouring process will permit the production of a product which surpasses the present wheat flour.

With regard to wet peeling, there are a number of questions which have to be answered before any attempt to predict new developments can be made. It seems feasible that a wet peeling process will be developed which will remove the bran layers outside the aleurone layers, and bread will be baked from wet-ground starchy endosperm and aleurone. Such a plant for separation could be visualized as a preliminary step to wheat processing, carried out in the bakery. This would save the need for the costly drying of the wet product, and also exclude the danger of damage, on storage, of a product containing particles originating from the aleurone layer. Such a product could meet the demands of consumers interested in a loaf of bread, slightly darker than the present white bread, but containing the valuable nutrients of

the outer layers of the wheat kernel. There seem to be a number of methods possible for such peeling, despite practical implications pointing to "unsurmountable" difficulties. Thus it might be possible to employ agents which facilitate skin removal. The controlled use of alkali or a similar agent, followed by application of reagents capable of counteracting the deleterious effect of the alkali on bread baking, might be one possibility. Flotation methods are being used in a number of food industries for skin separation. Thus the skins of wet ground sesame seeds are removed by flotation employing a sodium chloride solution. Any removal of outer pericarp by such a method, if applicable to wheat, would permit separation of part of the bran only, and its use would be restricted to a treatment carried out in the bakery immediately before use of wet dough in baking. The cost of drying and the danger of damage to baking quality by drying would make the method prohibitive.

In either germinated or moldy wheat, changes take place which modify the kernel and facilitate removal of outer layers of bran. But these processes are of course, deleterious to bread baking and it is unlikely that they could be controlled in practical peeling processes.

The changes taking place in germinating or moldy wheat are due to enzymatic action. One could, therefore, visualize the use of commercial enzyme preparations forced into the wheat kernel by an adequate conditioning process, in order to effect the separation. Experiments to employ enzymes, singly or in combination, along the lines recommended for analytical determination of fibrous matter by enzymatic procedures, were conducted by this author. The results were unsatisfactory, at least partly owing to the fact that the enzymes were allowed to act on whole intact wheat kernels.

A combination of any of these procedures, along with differential heat-treatment and repeated wetting, might be useful. None of these could bring about an 85% extraction flour equivalent in color and bran content to today's 74% extraction flour. The solution to this problem remains, so far, in the realm of wishful thinking.

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ERRATUM

Cereal Science Today, February 1961 issue (Vol. 6, No. 2)
Page 30, "Particle Size," by P. R. Crowley: The following table was inadvertently omitted.

Table I. Summary of Replies to Questionnaire on Particle Size Analysis

(Percent of respondents checking)

1. For what purpose would subsieve-size analysis methods be used in your organization? A. Research — 18; Quality control — 0; both — 82.
2. Are you now performing subsieve-size analysis in: Research — 45; Control — 0; Both — 55.
3. What maximum cost for particle size analysis equipment would be acceptable to your company? A. Less than $100 — 10; $100 to $500 — 10; $500 to $1,000 — 0; $2,500 to $5,000 — 70; $5,000 to $10,000 — 10.
4. What size range would you wish to cover? A. (a) Maximum limit: 200 μ — 36; 150 μ — 18; 100 μ — 46; 50 μ — 0. (b) Minimum limit: 1 μ — 18; 3 μ — 46; 5 μ — 27; 10 μ — 9.
5. What maximum working time would you consider acceptable? A. 15 minutes — 18; 30 minutes — 18; 1 hour — 55; 5 hours — 9; 24 hours — 0.
6. What operator requirements do you consider acceptable? A. (a) in Minimum background: College level — 9; High-school level — 91; No requirement — 0. (b) Minimum training time: 1 day — 10; 1 week — 70; 1 month — 20.
7. What level of repeatability do you consider acceptable? A. (a) Within laboratory: ±2% (95% level) — 59; ±5% — 41; ±10% — 0; 20% — 0. (b) Between laboratories: ±2% — 0; ±5% — 82; ±10% — 18; ±20% — 0.
8. Should the instrument be capable of predicting the size distribution of a blended sample from the size distribution and percentages of ingredients? A. Yes — 73; No — 27.
9. Is it necessary that the method agree with other methods or be amenable to "correction" factors which yield results agreeing with other methods? A. Yes — 64; No — 36.
10. What percentage of your analyses are or are expected to be on materials other than wheat flour? A. 0 to 5% — 64; 5 to 20% — 18; 20 to 50% — 9; 50 to 100% — 9.

Lone Star Section is host and Dallas, Texas, the locale for a pace-setting technical program prepared for the AACC's

46th Annual Meeting

WHAT'S NEW IN cereal research will be expounded, demonstrated, and illustrated during the upcoming meeting of the American Association of Cereal Chemists. This 46th annual gathering in Dallas, April 9–13, will be presented with 73 technical papers on both fundamental and applied subjects. Program Chairman Byron S. Miller of Kansas State University's Department of Flour and Feed Milling Industries has assembled a program so diversified that no one will be disappointed.

Laboratory Operation

For those interested in the practical side of laboratory operation and planning as well as shortcuts in technique, two sessions will be offered: LABORATORY LAYOUT and LABORATORY TECHNIQUES AND GADGETS. Such papers as "A Quantitative Measurement of the Squeeze Test for Bread Freshness," "Baking Laboratory Layout and Procedures," and "Simple Methods for Planning your Laboratory Space" are typical. "Work Measurement and Control in Quality Control Laboratory Operations" will be of value to many, as will "Dilatometry—Rapid Method of Finding Sample Size."

Feed Technology and Grain Studies

Feed chemists will have a full program of their own with the main emphasis on Tuesday, April 12, when two sessions on FEED TECHNOLOGY will be held, with time allowed at the end for discussions. Some of the titles are: "Biochemical and Biological Measures of the Effect of Pelleting on Starches"; "Feed Spoilage and Its Control in Mixed Feeds"; and "Determination of Supplemental Enzymes in Feed Products." "Feed Microscopy in Quality Control and Feed Microscopy Short Course" will inform on an important aspect. In a tangential area, the session on CHEMICAL RESIDUES IN CEREAL PRODUCTS offers "Bromide Residues in Cereal Products Resulting from Experimental Fumigations with Methyl Bromide," and "Fungicides on Grains: Food and Drug Administration's Methods and Policies," among others. After this session a panel discussion by authors, with questions from the floor, is scheduled. In addition, a number of AACC Technical Committee meetings scheduled for Wednesday afternoon, April 12, will be of direct interest to those in the feed industry.

A comprehensive session on CHEMISTRY AND TECHNOLOGY OF GRAIN presents "Corn Dry Milling: Vacuum Drastically Reduces Temper Time," and another, "On Glutamic Acid Decarboxylase Activity of Stored Wheat and Corn," among other papers.

Baking Technology

Baking chemists will have a unique opportunity to update their present knowledge on CONTINUOUS BREADMAKING during the session planned for Thursday afternoon, April 11. "Factors Affecting Quality and Their Control of Flour for Continuous Breadmaking Processes" and "Laboratory Equipment for the Evaluation of Ingredients and Factors Relative to the Continuous Processing of Dough" are among the topics to be discussed. Here also a panel discussion is scheduled. Included in other sessions, pre-ferments receive due attention, as in "Effect of Processing Variations on the Alcohol, Carbonyl, and Organic Acid Contents of Pre-Ferments for Bread-Baking." Papers presented on FLAVOR RESEARCH reflect the heightened interest in this field, with such subjects as "Why Is Flavor Research Desirable in the Bread-Baking Field?" and "Characteristics of Yeast-Leavened Flavor of Baked Goods." "A Novel Breadmaking Technique" is noteworthy. A session on CHEMISTRY AND TECHNOLOGY OF YEAST rounds out this part of the program. Overlapping in interest with FEEDS here is "Production of Fodder Yeast from Barley."

Laboratory on Wheels

Through the cooperation of the Union Machinery Division of American Machine and Foundry Co., members of the AACC will have an opportunity to inspect the company's "laboratory on wheels" (see photos). This converted semi-trailer will be parked beside the Baker Hotel in Dallas during the meeting. The laboratory is equipped to carry out the usual analytical and physical determinations made on bakery raw materials, as well as to control "liquid sponge fermentation" by the "AM-Flow" process and check the final end product—the bread itself. Moving to an installation site, the laboratory facilitates adjustment of the process quickly and methodically to the baker's particular requirements of raw materials and end products. It provides on-the-spot information under actual production conditions.

Further Coverage

The mill chemist is certainly not forgotten in the program, with

the largest of the twelve scheduled sessions devoted to the CHEMISTRY AND TECHNOLOGY OF FLOUR. Such papers as "The Effect of Starting Temperatures on Amylograms," "Preparation and Properties of Sulfated Wheat Flour," and the "Current Status of Knowledge on Wheat Flour Proteins" will be presented.

STARCH CHEMISTRY adds to the diversity of the program, with "A Comparison of the *in Vitro* Digestibility of High-Amylose Corn Starches with That of Other Starches," and "Measurements on Starch Gelatinization" as examples.

A session on LIPIDS will be of special interest to those working on mixes and various cereal products in diversified uses. "The User Looks at Bulk Lard Quality," "Antioxidant Losses from Stabilized Cereal Products," and "Some Characteristics of Yolk Affecting Cake Doughnut Performance" are good examples.

Civil Defense Training Course

The AACC meeting will adjourn at noon on Thursday, April 13, so that a special training course on Civil Defense *for the food industry* can begin at 1:30 p.m. This course is sponsored by the U.S. Food and Drug Administration and will conclude at 4:00 p.m. April 14. There will be no fee. The instructors will be officials of the Food and Drug Administration. In addition to vital information on survival after an enemy attack, those attending will receive valuable information that can be applied in the aftermath of any natural disaster. All food industry personnel are urged to attend this 1½-day training course. Further information can be obtained by writing: AACC, 1955 University Ave., St. Paul 4, Minn.

Local Arrangements

The Lone Star Section of the AACC will be host in Dallas, with Hugh Fetty of American Foods serving as Local Arrangements Chairman. Remembering that Texas just will not be outdone, come with expectations of a hearty welcome and the kind of entertainment you'll talk about long afterward. You'll be among about 500 cereal chemists who are expected to attend.

AMF Mobile Laboratory

The Officers and Directors of the American Association of Cereal Chemists

extend a cordial welcome to the following individuals who have recently joined the AACC

HOUGEN, FRITJOF W., *Head Chemistry Lab.,* Division of Plant Science, University of Manitoba, Winnipeg, Manitoba, Canada

HUBINGER COMPANY, The, Keokuk, Iowa. Attn: L. C. Watson

INGLE, JAMES D., *Technical Director* (Food Materials Corp.), 4021 Clausen, Western Springs, Ill.

INGLETT, GEORGE E. (Griffith Labs), 445 Colfax, Clarendon Hills, Ill.

JACOBSON, PHILIP (Quality Bakers of America), 125-3 S. Highland Ave., Ossining, New York.

L. KARP AND SONS, 126 South Green St., Chicago, Ill. Attn: Jos. Karp, Pres.

KARPIAK, EUGENE T., *Chief Chemist,* The Creamette Co., 428 No. 1st St., Minneapolis, Minn.

KING, WESLEY R. (American Maize), 6743 South East End Ave., Chicago 49, Ill.

LAMPSON, SIDNEY B. (Atlas Powder Co.), 107 Dogwood Drive, Richardson, Texas

LANIESSE, PAUL, *Professor and Director of Laboratory,* Ecole Francaise de Meunerie, 16 Rue Nicolas Fortin, Paris 13, France

LONG, JOHN P., *Quality Control Manager,* Bremner Biscuit Co., 654 So. 7th St., Louisville, Ky.

LUBERT, D. J., *Chief Chemist* (Canada Malting Co.), P.O. Box 248, Terminal A, Toronto, Ontario, Canada

MEREDITH, PETER, Wheat Research Institute, P.O. Box 1489, Christchurch, New Zealand

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MOLNAR, ROBERT (Capitol Milling Co.), 51624 Fountain Ave., Los Angeles 29, Calif.

MORRISON, B. W., *Manager Quality Control* (Ogilvie Flour Mills), P.O. Box 6089, Montreal, P.Q., Canada.

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PATTON, JAMES C., *Research Chemist* (Campbell-Taggart Bakeries), 3729 Matador Dr., Dallas, Texas

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ROBINSON, ROBERT J., Dept. of Flour & Feed Milling Ind., Kansas State University, Manhattan, Kansas

SCHEID, HAROLD E., Quaker Oats Co., 617 W. Main St., Barrington, Ill.

SCHULZE, WILLIAM E., Dept. of Flour and Feed Milling Ind., Kansas State University, Manhattan, Kansas

SHAEVEL, MORTON L., B. Manischewitz Co., 143 Bay St., Jersey City, N. J.

SHIDELER, RUSSELL D., *Control Lab Supervisor* (Evans Milling Co.), 3330 N. Guilford, Indianapolis, Ind.

SMITH, DONALD E., (Central Labs, Henningsen, Inc.), 2501 College St., Springfield, Mo.

STROZ, JOHN J., Procter & Gamble Co., Burlington St. E., Hamilton, Ontario, Canada

TAUBERT, C. A., *Quality Control Manager,* The Pillsbury Co., Box 22122, Los Angeles 22, Calif.

TAYLOR, ARTHUR T., (Fisher Flouring Mills), 15833-9th So., Seattle Wash.

TKACHUK, RUSSELL, *Research Chemist,* Grain Research Laboratory, 190 Grain Exchange Bldg., Winnipeg 2, Manitoba, Canada

TSEN, C. C., Grain Research Laboratory, 190 Grain Exchange Bldg., Winnipeg 2, Manitoba, Canada

VAN DER LAAN, G. J. J., Kon. Ind. My v/h Noury & van der Lande, Afd. Centrale Bibliotheek, Postbus 10, Deventer, Holland

VOTH, MENNO D., U.S. Food & Drug Administration, Federal Office Bldg., Minneapolis, Minn.

WEISSLER, HAROLD E., (Falstaff Brewing), 61 Tealwood, St. Louis 24, Mo.

WOLFE, HARRY C., *Chief Chemist* (Kellogg Company), 28 Piper Avenue, Battle Creek, Mich.

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METHOD FOR DETECTING FUNGICIDES ON GRAIN

S. MOLINAS, HEW-Food and Drug Administration, Bureau of Biological and Physical Sciences, Division of Microbiology, Washington 25, D.C.

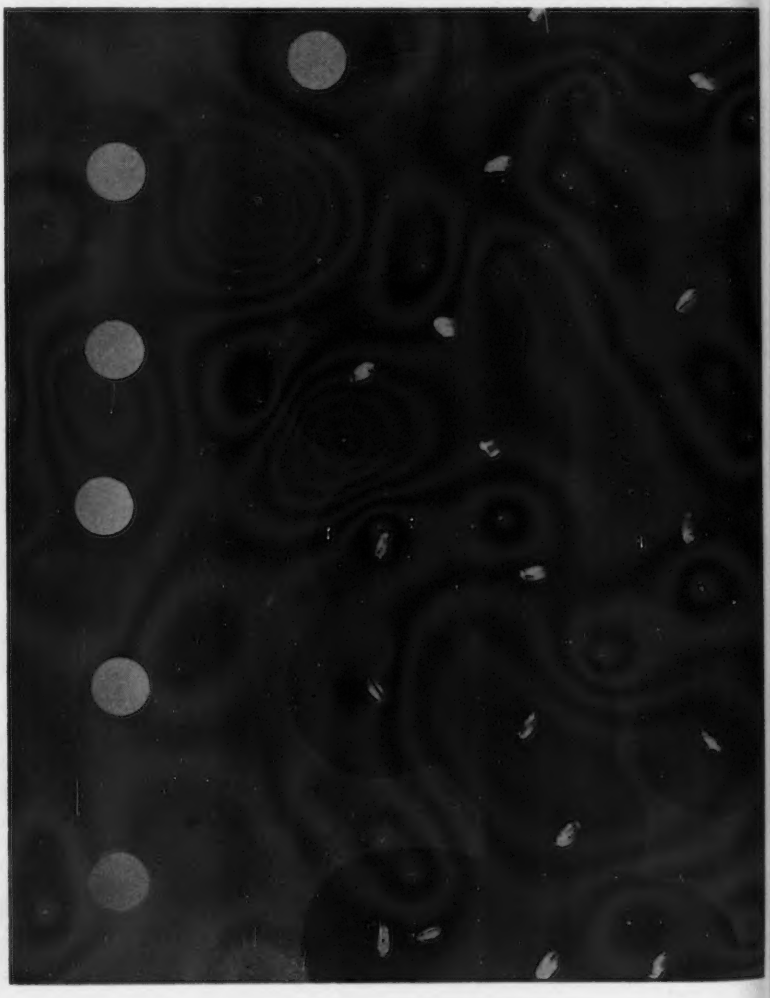
THE FOLLOWING METHOD was developed in this laboratory for detecting the presence of fungicides on grain. It is a relatively simple, nonspecific procedure which depends on the fact that most fungicides in contact with agar will diffuse out from the surface or from within the kernel of grain and inhibit the growth of a test organism. *Sarcina lutea,* which is sensitive to a number of fungicides, is used.

The use of the agar plate method for detecting fungicides on grains is not new; various investigators have studied this problem since 1945. In that year H. W. Mead (4) developed an agar plate method using the fungus *Helminthosporium sativum* as a "biological method of detecting the presence of fungicides on seeds." C. Leben and G. W. Keit (2) modified Mead's procedure by substituting the fungus *Glomerella cingulata* as the test organism in their procedure for assaying the quantity of tetramethylthiuram disulfide in seed corn. J. R. Machacek (3) modified the agar plate procedure by substituting *Penicillium purpurogenum* as the test organism. He employed greenhouse glass panes for holding the agar in his agar sheet method for testing the efficiency of seed-treating machines.

Previous methods which employed a fungus as the test organism required a 48-hour incubation period; substituting a bacterium, *Sarcina lutea,* as a test organism shortened the incubation period to 12–18 hours. This organism is sensitive to the following fungicides: Captan, tetramethylthiuram disulfide, ethyl mercuryphosphate, ethyl mercury-*p*-toluene sulfonanilide, methyl mercury dicyandiamide, ethyl mercurychloride, Vancide-89, chlorophenyl mercury sulfate, phenylmercuric acetate, phenylmercuric ammonium acetate, phenylmercuric urea. It was not sensitive to hexachlorobenzene and pentachloronitrobenzene. Fungicides were detected on wheat, corn, barley, and beans.

The method is relatively simple and does not require special equipment or media. Ordinary sterile nutrient agar, which is readily available in dehydrated form, is melted, cooled to 45°–50°C., and inoculated with 0.1 ml. of a 24-hour broth culture or saline suspension of the test organism per 20 ml. of agar. The agar is shaken and poured into Petri dishes or Pyrex baking dishes. Ten milliliters of agar per Petri dish were used when a few kernels were tested, and 100 ml. per baking dish when 100 kernels were tested in a

Fig. 1. Canadian "Canuck" treated seed wheat. White circles are paper disks saturated (top to bottom) with solutions containing respectively 4.0, 3.0, 2.0, 1.0, 0.5, and 00 μg. per ml. of "Ceresan M."



single dish. The grain is placed in the agar before it solidifies in order to leave about half the surface of the kernels embedded. The dishes are covered and incubated overnight either at 37°C. or at room temperature.

The presence of the antifungal agent is indicated by the absence of growth in a circular area around the kernel, giving the kernel the appearance of having a halo. The size of this zone is dependent upon the diffusibility of the fungicide and the quantity present in the portion of the kernel in contact with the agar. Absence of the fungicide is indicated by growth of the test organism up to the kernel of grain (see Figs. 1 and 2). The sensitivity of the test will vary with the fungicide, the depth of agar, and other factors such as the tenacity with which the fungicide is held to the grain or seed.

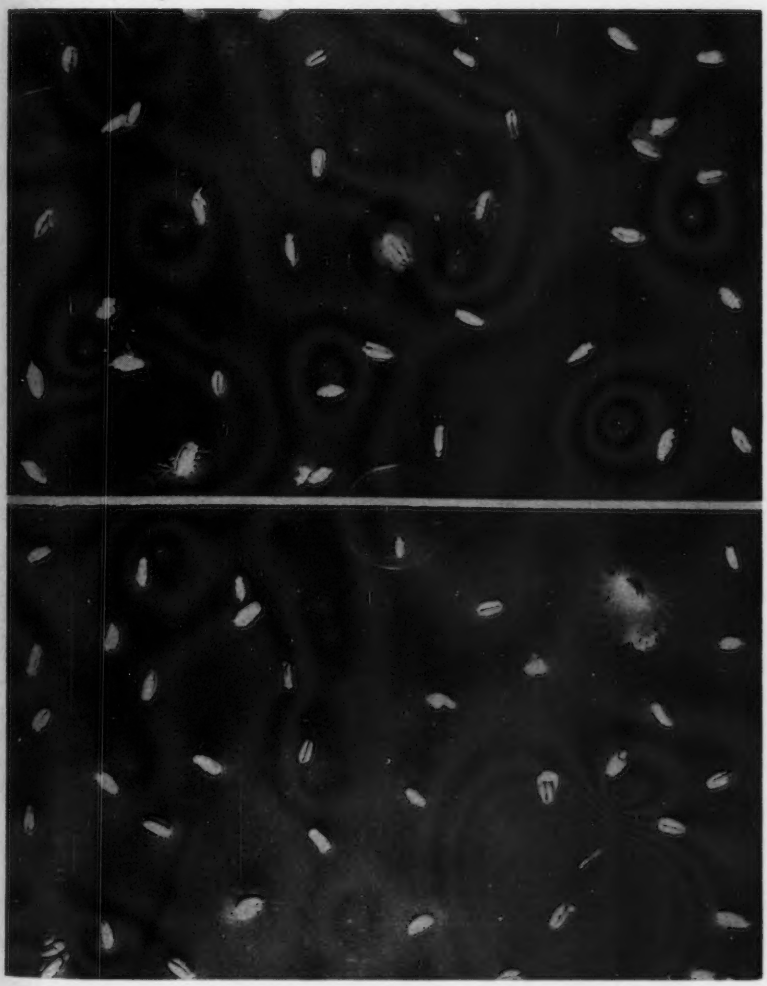
The method should be useful in detecting fungicides on grains or vegetable seed; determining the efficiency of scouring treatments; and, by means of photographs, as a graphic illustration of fungicide contamination in possible court actions.

The procedure is nonspecific and incapable of identifying the fungicide present on the grain. Hence, it cannot be employed as a quantitative test except where the fungicide present is known.

Application of the Test

The following fungicides were readily detected on samples of seed wheat of known treatment: Canuck-treated, Drinox-treated, Setrete-treated (¾ oz. per bu.), Setrete-treated (½ oz. per bu.), Panogen-treated (½ oz. per bu.), Panogen-treated (¾ oz. per bu.), and Ceresan-treated. Arasan on treated seed corn was also readily detected. Results on further samples of food grain are presented in tabular form; the majority of these samples had previously been investigated by Minneapolis District of the Food and Drug Administration (Table I).

Fig. 2. Sample 41-155 M "pink" wheat seized by the Minneapolis District. Top, before scouring; bottom, after scouring.



The Method

Apparatus. (1) Autoclave; large pressure cooker may suffice.
(2) Hot-air oven.
(3) Incubator.
(4) Bunsen burner.
(5) Test tubes, 20 by 150 mm.
(6) Nonabsorbent cotton.
(7) Bacteriological inoculating loop or needle.
(8) Sterile glass beads.
(9) Flask, 2-liter or larger.
(10) Flask, 250-ml. (or larger).
(11) Flasks, 50- to 125-ml.
(12) Test-tube rack.
(13) Sterile pipets (5-ml. and 1-ml. in 0.1).
(14) (a) Large Pyrex baking dish, or heat-resistant glass tray to handle 100 to 150 kernels.
(b) Where a large number of samples are to be handled at one time, the use of the largest glass tray which can be bought or improvised is suggested. An example would be the shallow sheet glass tray employed by Machacek (3) for this purpose. These were made of greenhouse glass panes, 16 by 24 by ⅛ in. thick, with glass strips 16 and 23 by ½ in. and ⅛ in. (rod tubing could be substituted) affixed to the sheet by means of an adhesive. (We have no knowledge of the ability of these trays to withstand sterilization.)
(15) Dish or tray covers: glass plates or thin-gage galvanized steel sheets cut to size.
(16) Paper template; marked as desired.
(17) Manual seed counter.
(18) Vacuum seed counter or any improvised contrivance which will facilitate distribution of kernels in a pattern.
(19) Petri dishes (tops and bottoms) 20- by 100-mm.
(20) A small pair of tweezers.

Culture Media. Either of the following media may be employed for carrying the test organism, preparation of the bacterial suspension, and for performing the screening procedure:
(a) Penassay seed agar (medium No. 1 in the assay procedure for detecting penicillin in milk) having the following composition:

	g
Peptone	6
Pancreatic digest of casein	4
Yeast extract	3
Beef extract	1.5
Dextrose	1
Agar	15

Distilled water to make 1,000 ml.

The final pH after sterilization is 6.5–6.6.
(b) Nutrient agar — having the following composition per liter:

	g
Beef extract	3
Peptone	5
Agar	15

The pH after sterilization should be 6.8–7.0. The above media with directions for their preparation are readily available in dehydrated form.

Prior to sterilization the medium employed should be dispensed as follows: (a) agar slants—approximately 10 ml. per tube 20 by 150 mm.

(b) agar for plates or trays—100 ml. per 250-ml. flask.

In preparing larger quantities of agar, flasks of appropriate size should be filled to approximately half of capacity.

After sterilization, place tubes for slants in an inclined position so that the agar is slanted down to the butt of the tube.

Test Organism. The test organism employed in this procedure is *Sarcina lutea* ATCC, 9341. Transfer stock cultures monthly. Incubate new stock cultures 48 hours at 35°–37°C. and maintain under refrigeration.

Preparation of Suspension. Inoculate entire surface of two or more fresh slants with the test organism and incubate at 35°–37°C. for 22–24 hours. Aseptically wash the growth from each slant with 5 ml. of sterile physiological saline and aseptically pour the resulting suspension into a sterile flask, 50- to 125-ml., containing approximately five sterile glass beads, and shake gently. Maintain the suspension under refrigeration and use as needed. Suspensions prepared and maintained in this manner will keep for 1 month.

Determination of Optimum Inoculum. In general add 0.1–0.2 ml. of bacterial suspension per 100 ml. of melted agar. The optimum inoculum for each suspension may be determined by preparing three plates with varying inoculum: 0.5, 0.2, and 0.1 ml. per 100 ml. agar. On each plate place control disk[1] (to be furnished by the Division of Microbiology). Cover, inoculate overnight at 37°C. or room temperature (26°C.), and note size and sharpness of the zones of inhibition.

Overnight incubation at room temperature results in lighter and less chromogenic growth; this necessitates the use of a heavier inoculum to obtain clear and distinct zones of inhibition.

Use inoculum which gives largest and most distinct zone of inhibition.

Preparation of Broth Cultures (Alternate Method). The composition and detailed directions for the preparation of the broth which can also be employed for this purpose may be found in AOAC *Methods of Analysis* (1). The use of broth cultures is not recommended since this medium is not available in dehydrated form, and daily transfer of the broth culture is required.

Screening Procedure. Melt agar, cool to 45°–50°C., add about 0.1–0.2 ml. of suspension (as determined for each new suspension) per 100 ml. of melted agar, shake gently, and distribute evenly into sterile plates or trays placed on a level surface. Use quantity of agar which will form a layer 2 mm. deep in the plate or tray being used for this procedure (10 ml. per Petri dish 20 by 100 mm.; 100 ml. per Pyrex tray 19 by 25 mm. Allow agar to harden slightly (about 5–7 minutes) and while still soft, distribute kernels evenly over the surface so that there is approximately a 15 mm. space between kernels. Distribution of grain in a pattern may be facilitated by placement of a paper template, cut to size and marked as desired, under agar tray or plate, by the use of manual or vacuum seed-counting heads, or by any other means which can be devised. Cover plates and incubate overnight at 35°–37°C. (or temperature used in standardizing inoculum).

The presence of the antifungal agent is indicated by a complete zone of inhibition (the absence of growth in a circular area around the kernel giving it the appearance of having a halo around it); this is a positive test. Absence of the fungicide is indicated by growth of the test organisms up to the kernel of grain being tested. Only kernels having a complete and distinct zone of inhibition should be considered as being positive.

Size of the Sample. Where practical, it is suggested that tests for detecting seed grain be made using 1000 kernels per sample. Tests conducted with known seized pink wheat samples indicate that negative results may be obtained when only 400 kernels per sample are examined.

Table I. Results on Samples of Food Grain

Grain		*History*	*No. of Kernels Tested*	*Number Positive*
Wheat	(1)	Hg on pick-outs, 6.5 p.p.m.	1,202	25
		After reconditioning by scouring (see Fig. 2)	1,396	19
Barley		Involved in livestock poisoning	60	60
Wheat	(2)	Hg, 0.6 p.p.m.	973	905
Barley		Hg, 15.6 p.p.m.	1,095	12
Corn		Thiram-treated 1954, retested 1957	291	14
Beans		Delsen- plus thiram-treated	10	10
Wheat	(3)	Pellet check (3 to 9 incl.)	1,097	0
	(4)		1,780	0
	(5)		1,783	1
	(6)		1,622	1
	(7)		1,328	0
	(8)		1,311	0
	(9)		942	0
Feed wheat	(10)	Damaged kernels	1,156	0
Wheat (authentic)		Untreated	965	0
Wheat	(11)	Brake end of car, before pick-out	943	17
		Brake end of car, after pick-out	1,032	4
		Non-brake end, before pick-out	1,074	9
		Non-brake end, after pick-out	1,114	1
		Center, before pick-out	867	3
		Center, after pick-out	986	2
Wheat	(12)	Brake end of car, after pick-out	1,160	2
		Near brake end, after pick-out	1,070	1
		Center, before pick-out	409	3

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3. Machacek, J. R. *Can. J. Research 28:* 739 (1950).
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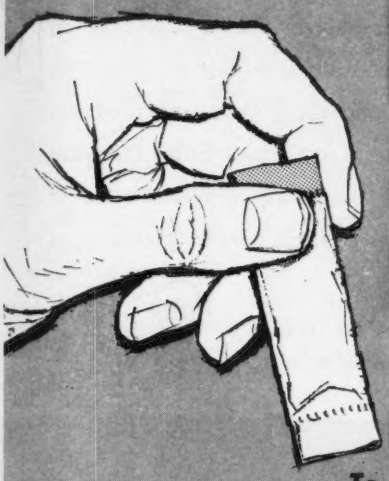
[1] N-Ethylmercury-p-toluene sulfonanilide "Ceresan" M disks may deteriorate with age since this compound is slowly volatile. Small sample of Ceresan M will be furnished on request.



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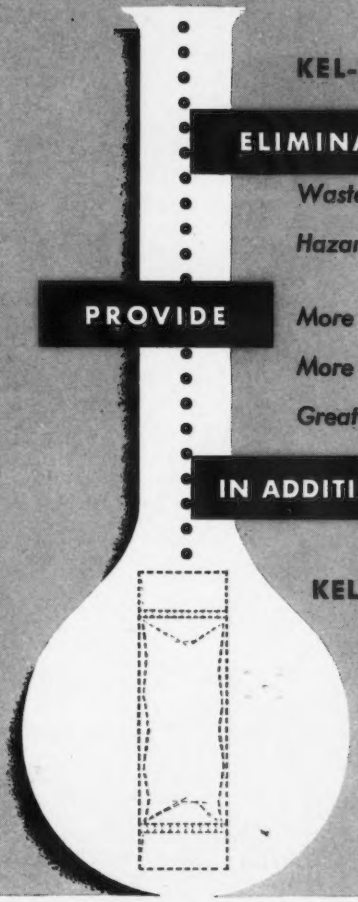

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A RAPID BACTERIOLOGICAL METHOD FOR PREDICTING ROPINESS IN BREAD

J. J. RUSS, WENDELL REEDER, AND D. W. HATCH, Campbell-Taggart Associated Bakeries, Inc., Dallas, Texas

THE CAUSATIVE AGENT of ropiness in bread has long been known. Lloyd *et al.* (7) isolated and studied six strains of bacilli of the *Bacillus mesentericus* group and found that each was capable of producing rope in sterilized bread. Strains formerly classified as *B. mesentericus* are now classified as *B. subtilis,* (3). Laurent (6) studied organisms in ropy bread and isolated similar organisms from flour, wheat, maize, rye, and soil. Barton-Wright (2) isolated nine different strains of rope-producing bacteria and found that all nine strains conformed to the standard (Marburg) strain of *B. subtilis.* Laurent (6), Watkins (9), and Lloyd *et al.* (7) observed that spores of rope-producing bacteria are very resistant to elevated temperatures. The spores survive baking temperatures and are later capable of producing the disease in bread.

Watkins (9) inoculated sterile slabs of bread with a boiled flour mixture containing suspected rope organisms. Lloyd *et al.* (7) developed a plating method which was not suitable for materials containing solid particles. Kent-Jones and Amos (1,5) used a dilution method employing nutrient broth. Hoffman, Schweitzer, and Dalby (4) extended the dilution technique of Kent-Jones and Amos and made spore counts in numerous materials important as sources of rope infection. These methods, however, have not shown a direct correlation of rope infection with the rope spore count of flour, the ingredient now considered as the most probable source of rope infection in bread.

The most practical method for determining whether flour will produce ropiness in bread has been the baking test. Results so obtained are entirely reliable if precautions are taken to maintain aseptic conditions throughout the process. However, these conditions are very difficult to maintain, and results cannot be obtained in less than 72 to 144 hours after baking. The present bacteriological method was developed in order to replace the baking test with a less tedious, more rapid procedure.

Correlation of results obtained by the method proposed herein with results obtained by the baking test shows that flour samples that produced ropy bread in 4 days invariably gave positive tests within 24 hours; and flour samples that produced ropy bread in 5 days gave positive results within 48 hours.

This paper reports a bacteriological method for determining whether ropiness in bread is due to the presence of rope spores in the flour used.

Baking Formula

Sponge

	%	
Flour	60	420 g.
Yeast	2.5	18 g.
Yeast food	0.6	42 g.
Sponge absorption	58.	244 cc.

Sponge temperature, 76°
Sponge fermentation, 4.5 hours

Dough

	%	g.
Flour	40	280
Salt	2	14
Sugar	8	56
Lard	2.5	18
Milk	3	21

Total absorption — variable
Dough temperature — 80°
Dough time — 60 minutes
Scale 500 g. per loaf (2 loaves per dough)
Intermediate proof — 14 minutes
Proof to height
Bake 18 minutes at 450°F.
Unsliced loaves
Incubated at 102°F. and 95% r.h.

Procedure

Apparatus: (1) Bottles, wide-mouth, round, glass-stoppered, 125-ml. capacity. Add sufficient glass beads (4-mm. diam.) to uniformly cover the bottom of each bottle.

(2) Pipets, bacteriological, single mark for total delivery of 10 ml.

(3) Culture flasks, narrow-neck, 300-ml.; plugged with nonabsorbent cotton.

(4) Filter paper S&S No. 576, 9.0 cm. diam.

(5) Waring Blendor.

(6) Sample bottles, 2-oz., with metal caps. Remove enamel from the caps by heating in 10% sodium metasilicate solution.

(7) Autoclave, controllable at 15 and 5 p.s.i.

Bacteriological Procedure: Dry-air sterilize all glassware at 325°–350°F. for at least 1 hour, prior to use.

Prepare culture medium by adding 700 ml. distilled water to 200 g. commercial white bread in a Waring Blendor bowl. Blend 30 seconds, add 45 ml. 0.100*N* NaOH and blend 1 minute longer. Adjust to pH 6.1–6.2 and dispense 100 ml. into each of the culture flasks. Sterilize in the autoclave for 30 minutes at 15 p.s.i. After sterilization the medium will have a pH of 5.8–6.0.

Weigh samples of flour, 5.0 g. ± 0.01 g., on tared filter paper circles, and transfer from the filter paper to the glass-stoppered bottles. Add 100 ml. distilled water to each bottle and shake 15 times with whip-like motion. Allow to stand 30 minutes, shake 15 times, and pipet 10 ml. of suspension of each sample into respective culture flasks previously cooled to room temperature. The sample should be drawn into the pipet within 10 seconds after shaking to avoid undue settling of flour. Swirl each flask to uniformly distribute the sample in the culture medium and sterilize in the autoclave for 10 minutes at 5 p.s.i. Cool to approximately 40°C., swirl and incubate at 38°C. Examine at intervals of 20, 24, and 48 hours for pigment formation, wrinkled surface, and ropy odor. The ropy odor closely resembles that of overripe cantaloupe and serves to detect the initial development of ropiness in the test cultures. Production of ropy odor within 20 to 24 hours corresponds to development of rope in bread within 4 to 5 days, under incubation at 102°F. and 95% r.h. Ropy odor within 48 hours indicates that rope spores are present and additional samples of flour from the same mill should be checked. Pigment formation and wrinkled surface usually follow development of ropy odor. The pigment is usually red or golden.

Culture Medium — General Consideration

A culture medium prepared from ordinary white bread was considered more likely to indicate the rope spore content of flour for baking purposes, because of the characteristic ropy odor produced in it.

The pH of the medium should be adjusted to permit development of rope within 24 hours, corresponding to its development within 4 to 5 days in bread baked and stored under standard conditions. In order to be satisfactory for commercial sale, bread baked under

standard conditions and stored at 100°–102°F. at 95% r.h. should not develop rope in 4 to 5 days.

The inoculum should be such that development of rope occurs in 24 hours when 100 ml. of medium are used.

The medium should be thoroughly sterilized prior to inoculation. All vegetative cells and spores must be destroyed.

Possible inhibition by calcium acid phosphate and by sodium and calcium propionates has been investigated by O'Leary and Kralovec (8), who found that 0.25% calcium acid phosphate in bread retarded rope development slightly, whereas 0.188% calcium propionate provided effective inhibition at pH values as high as 5.8. At pH 5.6, concentration of 0.156% calcium propionate was effective. These results indicate that the concentration of calcium acid phosphate normally encountered in the culture medium would not be inhibitory. However, it was necessary to determine the effect of calcium propionate at pH 5.8–6.0.

Thermal Resistance of Spores

Sterilization at 5 p.s.i. Cultures made with the standard bread medium of final pH 5.9 and five samples of ropy flour produced very ropy bread in 4 days and gave strongly positive results in the standard medium within 24 hours at inoculation levels of 0.40 and 0.50 g. A standard flour was prepared by blending equal portions of each flour. The standard flour was used in the following tests.

Each of 33 flasks of medium was inoculated with 0.50 g. Standard flasks in each group were sterilized for 15, 30, and 45 minutes respectively. The following results were obtained after 48 hours of incubation.

	Time Sterilized (Minutes)		
	15	*30*	*45*
	(Group 1)	*(Group 2)*	*(Group 3)*
Number positive	11	8	0
Number negative	0	3	11

Sterilization for 15 minutes at 5 p.s.i. is not harmful to spores of *B. subtilis.*

Sterilization at 15 p.s.i. The possibility of obtaining ropy medium from the bread used was checked by adding a suspension of dry mixed culture in water to the medium. A dried, mixed culture of spores was obtained by combining equal portions of the liquid cultures obtained in Group 1 of the tests carried out at 5 p.s.i. The mixed culture was dried in a flat container at 100°F., after which it was ground to pass a U.S. No. 40 sieve. Rope developed in bread baked from a dough of 1,269 g. containing 50 ml. of spore suspension (1.0 g. spore culture per 1,000 ml.) in 3 days. The following tests were carried out using media containing twice this amount of spore suspension (18 ml. suspension per 200 g. bread):

Four controls were sterilized for 10 minutes at 5 p.s.i. The remaining 16 cultures were sterilized 30 minutes at 15 p.s.i.

Controls: All positive in 24 hours.

Test cultures: All 16 negative in 24 hours.

These results indicate that culture media prepared from white bread can be rendered completely sterile by autoclaving for 30 minutes at 15 p.s.i. Bacteria, other than rope spores, introduced by inoculation with flour suspension, are destroyed by sterilization for 10 minutes at 5 p.s.i.

Effect of pH of the Medium

The effect of varying the pH of the medium is shown in Table I.

At pH values of 6.4 and 6.6 the amount of inoculum is greatly reduced and becomes critical. The small samples required are subject to errors in weighing and in sampling. Selectivity does not seem as good at higher pH values, indicating that spores which fail to develop at the normal pH of bread develop more readily at appreciably higher pH values.

Effect of Quantity of Inoculum

Data obtained with media at pH 5.9 to 6.0, varying the amount of inoculum (Table II), indicate the proper range to be 0.40–0.60 g. flour at ph 5.9–6.0. Additional results (Table III) at 0.600 g. inoculum show that false positive may be obtained at this level. Accordingly, comparative results were obtained at 0.400- and 0.500-g. levels. (Table IV.)

The following conclusions may be drawn:

1. Samples producing ropy bread after incubation for 4 days become positive at both inoculation levels within the 24-hour incubation period.

Table I. Effect of pH

Sample No.	*Bakeshop Results*	*Bacteriological Results after 24 Hours*					
		Inoculum (g.)					
		0.500[a]	*0.100*[b]	*0.150*[b]	*0.200*[b]	*0.100*[c]	*0.150*[c]
1	(−) 4	(−)	(−)	(−)	(+)	(−)	(+)
2	(−) 4	(−)	(−)	(+)	(+)	(−)	(+)
3	(+) 4	(+)	(+)	(+)	(+)	(+)	(+)
4	(+) 4	(+)	(+)	(+)	(+)	(+)	(+)
5	(−) 4	(−)	(−)	(−)	(+)	(−)	(+)
6	(+) 4	(+)	(−)	(+)	(+)	(−)	(+)
7	(+) 5	(+)	(−)	(+)	(+)	(−)	(+)
8	(+) 4	(+)	(+)	(+)	(+)	(+)	(+)

[a] Final pH: 5.9.
[b] pH, 6.4.
[c] pH, 6.6.

Table II. Variation of Inoculum

Sample No.	*Bakeshop Results*	*Inoculum (g. flour) and Hours Inoculated*									
		1.00		*0.800*		*0.600*		*0.400*		*0.100*	
		24	*48*	*24*	*48*	*24*	*48*	*24*	*48*	*24*	*48*
1	(−) 4	S(+)	(+)	(+)	(+)	(−)	(+)	(−)	(−)	(−)	(−)
2	(+) 6	(+)	(+)	(+)	(+)	(−)	(+)	(+) 5/	(+)	(−)	(−)
3	Sl. (+) 5	(+)	(+)	(+)	(+)	(+)	(+)	(−)	(+)	(−)	(−)
4		(+)	(+)	(+)	(+)	(−)	(−)	(−)	(−)	(−)	(−)
5		(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(−)	(−)
6		(+)	(+)	(+)	(+)	(+)	(+)	(−)	(−)	(−)	(−)

Table III. Results, 0.600 g. Inoculum

Sample No.	24 Hours	48 Hours	Bakeshop and Bacteriological (Comparative)
7	Sl. (+)	(+)	(−) 4
8	Sl. (+)	(+)	(−) 4
9	Sl. (+)	(+)	(−) 4
10	(−)	(−)	(−) 4
11	(−)	(−)	(−) 4
12	(−)	(+)	(−) 4

Table IV. Comparative Results, 0.500 and 0.400 g. Inoculum, 24 and 48 Hours

Sample No.	Bakeshop	0.500 g. 24	0.500 g. 48	0.400 g. 24	0.400 g. 48
	days				
1	4[a] 5 (+)	(+)	(+)	(+)	(+)
2	(−) 4	(+)	(+)	(+)	(+)
3	(+) 4	(−)	(+)	(−)	(−)
4	(+) 4	(+)	(+)	(+)	(+)
5	(+) 4	(+)	(+)	(+)	(+)
6	(+) 5	(+)	(+)	(+)	(+)
7	(+) 4	(+)	(+)	(+)	(+)
8	(−) 4	Sl. (+)	(+)	(−)	(−)
9	(+) 4	(+)	(+)	(+)	(+)
10	(−) 4 (+) 6	(+)	(+)	(−)	(−)
11	(−) 4	Sl. (+)	(+)	(−)	(−)
12	Sl. (+) 5	Sl. (+)	(+)	(−)	(−)
13	(−) 4 (+) 5	Sl. (+)	(+)	(−)	(−)
14	(−) 4 (+) 6	(−)	(+)	(−)	(−)

[a] Off-odor developed.

2. Samples producing ropy bread in 5 or 6 days may be negative in laboratory test after 24 hours of incubation using 0.400 g. inoculum; at 0.500-g. inoculum level these samples are positive or slightly positive within 24 hours.

3. When the method is to be used as an exclusion test, 0.500-g. inoculation should be used.

Effect of Propionate on Germination of Rope Spores in the Standard Medium

The effect of propionate on the results obtained by the proposed method was checked at inoculation levels of 0.450 and 0.500 g. Sixteen samples of ropy flour were employed at both levels using media free of propionate. The tests were duplicated using media containing calcium propionate equivalent to 0.30% in the bread based on (flour) used to prepare the medium. The results are given in Table V.

Table V. Effect of Propionate

Proprionate Not Added

Sample No.	Baking Results	(Final pH: 5.9; 0.450 g. Inoculum) 20 Hours	24 Hours	48 Hours	(Final pH: 6.0; 0.500 g. Inoculum) 20 Hours	24 Hours	48 Hours
1	+4	(−)	(+)	(+)	(−)	(+)	(+)
2	+4	(−)	(+)	(+)	(−)	(+)	(+)
3	+4	(−)	(+)	(+)	(+)	(+)	(+)
4	+5	(−)	(−)	(−)	(−)	(−)	(−)
5	+5; −5	(+)	(+)	(+)	(−)	(−)	(+)
6	+6	(+)	(+)	(+)	(+)	(+)	(+)
7	+4	(−)	(−)	(−)	(−)	(−)	(+)
8	+5	(+)	(+)	(+)	(+)	(+)	(+)
9	+5	(+)	(+)	(+)	(−)	(+)	(+)
10	+5	(+)	(+)	(+)	(+)	(+)	(+)
11	Sl. +5	(−)	(−)	(+)	(−)	(−)	(+)
12	+4	(+)	(+)	(+)	(+)	(+)	(+)
13	+5	(−)	(−)	(+)	(−)	(−)	(−)
14	+4	(+)	(+)	(+)	(+)	(+)	(+)
15	+4	(+)	(+)	(+)	(+)	(+)	(+)
16	+4	(+)	(+)	(+)	(+)	(+)	(+)

0.30% Propionate as Calcium Propionate

	(Final pH: 5.9; 0.450 g. Inoculum) 20 Hours	24 Hours	48 Hours	(Final pH: 5.9; 0.500 g. Inoculum) 20 Hours	24 Hours	48 Hours
1	(−)	(+)	(+)	(−)	(+)	(+)
2	(−)	(+)	(+)	(+)	(+)	(+)
3	(+)	(+)	(+)	(+)	(+)	(+)
4	(−)	(−)	(−)	(−)	(−)	(+)
5	(−)	(−)	(−)	(+)	(+)	(+)
6	(−)	(+)	(+)	(−)	(+)	(+)
7	(−)	(−)	(−)	(−)	(+)	(+)
8	(+)	(+)	(+)	(+)	(+)	(+)
9	(−)	(+)	(+)	(−)	(+)	(+)

All samples of flour producing bread that became ropy in 4 days were positive in all tests within 24 hours. Sample 5 was variable in baking tests and in the bacteriological tests. Variations encountered with samples producing ropy bread after 5 to 6 days of incubation appear to be due to sampling technique. The results found indicate that propionate present in commercial bread does not alter results obtained in the culture medium at pH 5.8 – 6.0.

Correlation of Baking Tests with Bacteriological Results

The results obtained by both methods (Table VI) are given in accordance with the number of days incubated, and were collected in a routine checking procedure. None of the samples were duplicated.

Table VI. Correlation of Baking Tests with Bacteriological Results

Baking (+)	Baking (−)	Days Incubated	Bacteriological 24 Hours (+)	24 Hours (−)	48 Hours (+)	48 Hours (−)
9	79	4	10	78	13	75
6	77	5	3	80	5	78
3	46	6	0	49	2	47

Samples of flour producing ropy bread after incubation for 4 days invariably produced positive cultures in the bacteriological test. Samples producing ropy bread in 5 days were positive within 48 hours with one exception. One-half of the positive samples gave positive cultures with 24 hours. Only two of the three samples which were positive in bread after 6 days were detected within 48 hours in the test medium.

Discussion

The culture medium prepared from white bread appears to be entirely satisfactory for determining potential ropiness in bread resulting from rope spores in flour. Cultures becoming positive (as indicated by ropy odor and pigment formation) within 24 hours indicate that bread baked with the same flour will produce bread that is potentially ropy. These results were confirmed by baking tests and by incubation of the bread under standard conditions.

The presence of the spores or bacilli of *B. subtilis* in the bread used

(Please turn to page 102)

People, Products, Patter

• • • People

Alex Apostolina promoted to project leader, General Foods Research Center, from associate technologist in engineering research. **Richard B. Kohler** promoted to same position; had been associate technologist. **Warren S. McGregor** also becomes project leader, in packaging development group; from Food & Container Institute for Armed Forces since 1953.

Francis A. Baldauski appointed manager of newly created food chemicals division of Sterwin Chemicals Inc., from assistant sales manager; he joined the company in 1959.

George Y. Brokaw, head of distillation development laboratory at Distillation Products Industries (division of Eastman Kodak Co.), named senior research associate. He joined their organic research group in 1947.

Frederick L. Dunlap died on October 8 at Westlake, Ohio, at age 90.

Dr. Dunlap was an original member of the U. S. board of Food and Drug Inspection. He served from 1907 to 1912 as an associate in the Bureau of Chemistry of the USDA, and during the same period was on the Food and Drug Board. He was with Wallace & Tiernan, Inc., from 1920 and was for some years a consulting chemist in Chicago. Among his numerous works was a monograph on "White versus brown flour."

Dr Dunlap was for many years a member of the AACC, he was a loyal supporter of the Association and a faithful attendant at meetings.

Clifford L. Fiala appointed assistant to general production manager of the Kellogg Company plant, headquarters Battle Creek, Mich.; from

Stine

Sugden

general manager, Memphis plant; will supervise Field Service Department, overseeing manufacturing and packing processes and methods. **Earl Stine** replaces Mr. Fiala at Memphis, from general manager of company's plant at San Leandro, Calif.; has previously been in production work for Kellogg at Battle Creek and Omaha plants. **John Sugden,** assistant general manager at San Leandro, becomes general manager there; has also worked at Battle Creek plant and at San Leandro since 1952.

Warren R. Godfrey wins Fritzsche Bros. new trophy as "Salesman of the Year," not only for a fine personal sales record but also for cooperation "beyond the call of duty" when he maintained contacts of a fellow salesman during the latter's prolonged illness. Mr. Godfrey has been with the firm 25 years.

David C. Herting, senior research biochemist at Distillation Products Industries, shares glycerine research award with **C. G. Youngs,** Prairie Regional Laboratory of National Research Council of Canada. The award, $750, is first in the basic science category; given by the Glycerine Producers' Association for work on the metabolism of distilled acetylated monoglycerides and related fats. Dr. Herting joined DPI in 1954, working on nutrition, metabolism, and analysis of fats and fat-soluble vitamins.

Werner M. Honsch elected a Fellow of the Royal Australian Chemical Institute, Melbourne. Dr. Honsch's office and home are in Unley, South Australia, near Adelaide.

J. H. Hulse appointed deputy director of research, Maple Leaf-Purity Mills Ltd., Toronto, from head of food research in Defense Research Medical Laboratories there. He is a past-president, Canadian Inst. of Food Technology.

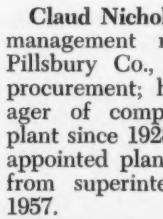
John A. Johnson, AACC President, discussed his current studies on compounds contributing to bread flavor before a seminar of Wallerstein Co. researchers in New York, on Jan. 10.

William R. Johnston joins International Milling Co., Minneapolis, as vp-research; from same position with Standard Brands, Inc., since 1950. He replaces H. H. Schopmeyer, director of research, whose resignation takes effect March 1.

Albert M. Juergens, Jr., joins Wallerstein Co. as assistant to president; from position with American Cyanamid Co.

E. Everett MacDonough, Jr., appointed manager, special accounts, Sterwin Chemicals Inc.; formerly associated with Chas. Pfizer & Co., Inc. He is director of New York Section IFT.

Claud Nicholson becomes senior management representative, The Pillsbury Co., primarily in grain procurement; has served as manager of company's Enid, Okla., plant since 1928. **Donald W. Pollei** appointed plant manager at Enid, from superintendent there since 1957.



Keith L. Thomas named to new position of director of planning and new products, General Mills' Grocery Products Division; from department head in the company's Central Research Laboratories.

Bob West becomes assistant director of biological laboratories, Rosner-Hixson Labs., Inc., Chicago, independent consulting firm; from research associate at Jefferson Medical college and research pharmacologist with American Cyanamid.

Try this texture trick

Pour ½ cup of plain, dry farina and a teaspoonful of salt into 3 cups of boiling water and cook until done. To another ½ cup of the same dry farina, add 3% of *Myverol*® *Distilled Monoglycerides, Type 18-07*, little white beads closely resembling the farina itself in appearance. (Write us for a free sample.) Pour *that* with its teaspoonful of salt into 3 cups of water, not boiling but at any temperature below 140 F. Then boil *that* until done.

Now set both pans aside for a few hours. Keep them both warm or let them both cool. It doesn't matter.

Come back and note which panful has turned into a jellylike mass and which still looks and behaves as it did at the moment the cooking was finished. See if you can taste a difference. (You can't.)

The difference is that the monoglyceride has complexed dissolved amylose and has thereby prevented gelation. The effect works with any starchy food.* We demonstrate with farina just because it photographs well!

Write for your sample of *Myverol Distilled Monoglycerides, Type 18-07*, to ***Distillation Products Industries,*** Rochester 3, N. Y. Sales offices: New York and Chicago • W. M. Gillies, Inc., West Coast • Charles Albert Smith Limited, Montreal and Toronto.

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distillers of monoglycerides made from natural fats and oils

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Distillation Products Industries *is a division of* **Eastman Kodak Company**

• • • Products

Edible whey. In-plant research by Western Condensing Co., Division of Foremost Dairies, doubling or tripling the amount of Sweet Dairy Whey over previously recommended levels, has shown that dough costs are substantially lowered and the quality and nutrition values of baked products are boosted. When used to completely or partially replace other milk products, the whey delivers maximum dairy solids performance at a level of about 8 to 10%, according to the company's announcement. Western's Technical Service Staff is now making complete details available to all interested bakers.

• • •

Edible lubricant. No. 175 Multi-Purpose White Machinery Lubricant is a product of Lubrication Engineers, Fort Worth, Texas, who describe it as a white, buttery-textured lubricant – so pure that it is actually edible, yet as tough and durable as the most advanced heavy-equipment grease. They call it the answer to the food and beverage processors' lubrication dream. Reports from users in these industries highlight the following advantages in comparison with the usual lubricants: 1) virtual elimination of bearing wear; 2) ten times less consumption of lubricant; 3) tripling of lubricant service life; 4) six and seven times less labor required for application; 5) no lubricant contamination of the food; and 6) absolute purity. Further details and case history examples are available. Write to Paul Ridings Public Relations, 3467 W. Freeway, Fort Worth 7, Texas.

• • •

Gum arabic. A new "super-refined grade" of gum arabic known as "Arabasan" is a spray-dried, snow-white powder that is virtually colorless in solution. It is described as almost completely free from sediment and impurities, having low moisture content – less than half that of present commercial gums. Analytical data, free sample for laboratory purposes, and price information are available from Tetroid Co., Inc., 1 Utica St., Hamilton, N.Y.

• • •

Flavors and oils. Available on request to those who purchase in wholesale quantities is Fritzsche Bros.' January 1961 price list covering a complete line of flavors, essential oils, and related items. Write to Fritzsche Bros., Inc., 76 9th Ave., New York 11, N.Y.

Measured-calorie food product. "Subtract," now being introduced by General Mills, is "calorie-low" and "nutrient-high" – coming in convenient foil packets of 225 calories each; four packets a day (900 calories) contain 70 g. of high-quality protein and all the vitamins and minerals needed according to established levels for humans, meeting or exceeding minimum daily adult requirements. Pleasing taste (chocolate, vanilla) and the convenience of the packet form – to be carried in pocket or purse and mixed in a glass of water – are important features.

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New D & O catalog. Dodge & Olcott, Inc., presents its semiannual price catalog of essential oils, aromatic chemicals and specialties, and certified colors (October 1960; 36 pages). Included are short descriptions and uses of various products; addresses and phone numbers of the various branch offices. Copies available on request to Dodge & Olcott, Inc., 180 Varick St., New York 14, N. Y.

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Fritzsche Bros. catalog. A new wholesale catalog is out (October 1960) covering Fritzsche Bros. products – essential oils, concentrates, aromatic chemicals, tinctures, colors, and other items. It is available on request to those who purchase in wholesale quantities. A separate catalog on flavors gives prices and descriptions. For either or both: Fritzsche Bros., Inc., 76 9th Ave., New York 11, N. Y.

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Automatic, fast filter. The speedfilter, with high pressure and variable filter design (Spincraft, Inc., Milwaukee, Wis.), is said to reduce filtration of large volumes of light or heavy precipitates to minutes instead of days. Two filter tanks, both 3.5 liters, may be run simultaneously or independently. Filter disks are rigid, sintered stainless steel. With change of filters, the apparatus handles all types of particulate matter, both organic and inorganic. It accepts ordinary filter paper or asbestos pads; or by simple substitution of a cellophane filter, converts to an ultrafilter. It requires 15 by 22 inches of surface area and operates on regular 115-volt, 60-cycle, AC power supply. For further information write: Spincraft, Inc., 4122 W. State St., Milwaukee 8, Wis.

New design in laboratory microscopes. Bausch & Lomb announce major changes in instrument design with their new DynaZoom microscopes. The line is produced especially for laboratory use in educational institutions, public-health and hospital laboratories, industry, and many types of quality-control work. MicroZoom is described as a revolutionary optical system which eliminates image blackout and focus shift while permitting continuous, clear magnification within the entire range of the instrument. Range of the series extends from 17.5x to 1940x. For complete details on the DynaZoom series write to Microscope Sales Dept., Bausch & Lomb Inc., Rochester 2, N.Y., specifying catalog No. D-185.

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Approved food ingredients. Two additional products of the Atlas Powder Co. have been approved by the Federal Food & Drug Administration under a food additive order of January 6: TWEEN 60 and SPAN 60 – sorbitan monostearates for such uses as in cake mixes, whipped vegetable toppings, and confectionery coatings. Information on labeling requirements and on use levels allowed by the FDA ruling, singly and in combination, is available from Atlas' Chemicals Division sales offices.

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• • • Patter

Brewing chemists' convention. The 1961 convention of the American Society of Brewing Chemists will be held at the Granada Hotel, San Antonio, Texas, from Sunday, April 30, through Thursday, May 4. Entertainment awaiting members and guests includes "A Night in Old San Antonio" at La Villita; an afternoon tour of the School of Space Medicine at Brooks Air Force Base; and brewery tours and luncheons provided by both the Lone Star and the Pearl brewing companies.

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Check sample program. The American Association of Feed Control Officials will again sponsor the alfalfa meal check sample program for the American Alfalfa Dehydrators Association. Four samples will be submitted to each collaborator for carotene analysis during 1961, each participant receiving a summary of the results following analysis of the individual samples. The collaboration fee for the four samples will be $2.00. All those inter-

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VICO 400
in Dry Mixes; Breads and Rolls; Biscuits;
Sweet Goods and Coffee Cakes; Muffins;
Waffles and Pancakes, etc.

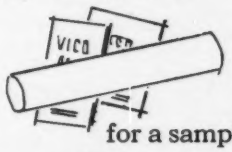
NOW AVAILABLE...A NATURAL INSTANT FERMENTATION FLAVOR...

that imparts true yeast-leavened flavor and aroma in chemically leavened baked goods without time consuming dough fermentation.

VICO 400, a unique NATURAL flavoring captures the full spectrum of flavor notes characteristic of natural yeast fermentation.

VICO 400 initiates a new concept of flavor production. It brings out—INSTANTLY—a true yeast-leavened flavor in various baked products, thereby intensifying and improving their taste appeal. It is especially effective in combination with the blander types of chemical leavening agents in such products as: dry mixes; breads; rolls; biscuits; sweet goods and coffee cakes; muffins; waffles, pancakes, etc.

VICO 400 is a dry, highly stable flavoring in powder form, easy to handle and ready to use at any time.



To form YOUR OWN impartial judgment, send for a sample and information on how to use VICO 400 to best advantage in your formulas. A thoughtful comparison of flavors will demonstrate an unmistakable new taste experience in VICO 400 products.

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ested in participating should notify B. W. Southall, Division of Chemistry and Foods, 1122 State Office Building, Richmond 19, Va.

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Cereal chemists' luncheon. The annual Cereal Chemists' Luncheon will be held during the meeting of the American Society of Bakery Engineers, March 6 to 9 in Chicago, at Edgewater Beach Hotel. The luncheon is Wednesday, March 8. Tickets should be purchased from Tod Stewart or R.C.A. Bradshaw.

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Meeting of AOM group. Members of Flour City District, Association of Operative Millers, met Saturday, Jan. 28, at the Pick-Nicollet Hotel, Minneapolis, for a morning program, luncheon, and business meeting. This program was preceded by meetings on Thursday and Friday of the Sanitation, Educational, and Technical Research committees.

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Brochure on rodent infestation. The Black Light Eastern Corporation, 4 Manhasset Ave., Port Washington, L. I., offers a free brochure entitled "One Hundred Million Rats." The brochure describes the corporation's equipment for producing "black light" and its uses in detecting and combating rodent infestation. The Black Light Eastern Corp. are consultants in ultraviolet technology and special effect lighting; they manufacture, in addition to the above, short- and long-wave lamps for chromatography and other laboratory techniques; small, pencil-type short-wave sources; and fluorescent materials. They engage in research and development on special lamps and materials in all of these fields. They will welcome inquiries.

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Research firm expansion. Harris Laboratories, Inc., Lincoln, Neb., have completed and moved into their new office and laboratory building at 624 Peach St. They announce that several staff scientists will be added this year to provide new specialized research services in drugs and in utilization of agricultural products and by-products.

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Millers' convention — 1962. The city of Seattle has been selected by the Millers' National Federation for its annual convention in 1962. In April of that year, the International Fair, "Century 21," will be opened, in the heart of Seattle. Members are being urged not to make any other vacation plans until they hear about all the attractions of a holiday in the Pacific Northwest — and a World's Fair, too!

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Crop improvement recognition. The 33rd annual recognition dinner, sponsored jointly by the Minnesota Crop Improvement Association and the Crop Quality Council, was held on January 18 to confer honors for outstanding contributions and achievements. "Premier Seed Growers," elevator managers, and seedsmen were so honored with plaques and scrolls recognizing their accomplishments. Attendance was 350, showing the fine cooperation of producers, handlers, processors, scientists, and other agricultural-minded groups.

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AOAC award. The Association of Official Agricultural Chemists is offering the Harvey W. Wiley Award, a $500 grant to a scientist making the most outstanding contribution to the development of analytical methods.

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Additives legislation. In a talk before the Industrial Hygiene Foundation of America, Kenneth E. Mulford of Atlas Powder Co., discussed the effects of additives legislation on food technology from industry's viewpoint. Mr. Mulford is chairman of the Food Additives Committee of the Manufacturing Chemists' Association. He said the chemical industry favors a change in the Food Additives Amendment of 1958 to provide for an ad hoc scientific advisory committee to consider any question arising under the cancer clause, in the hope that this procedure will assure some measure of independent scientific advice. With the exception of the cancer clause, which the industry still strongly believes is unnecessary and unwise, Mr. Mulford said the new law appears practicable and workable.

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Bakers' cooperative in conference. Quality Bakers of America Cooperative Inc., in its 52nd General Conference held recently in New York City, considered the nutrition needs of the nation's teenagers—as high or higher than those of adults. It was brought out that according to a study made by the Department of Agriculture, poor nutrition is common in the adolescent age group. Some 400 Q.B.A. member-bakers and their administrative assistants attended the conference.

Food and Drug research. Comment in a recent issue of "What's New in Food and Drug Research": Flavor panels are yielding to instrumentation. "The possibility that gas chromatograms, properly interpreted, may offer valid criteria for the quality control of flavor is a recurring suggestion which seems to be receiving serious consideration in several applications.

CLASSIFIED

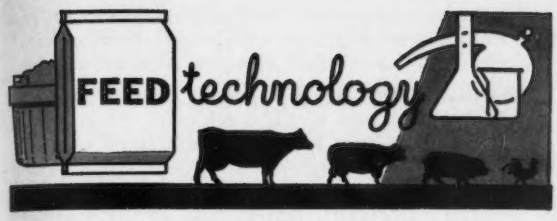
FOR SALE: Brabender Rapid Pilot Mill, Type MA No. 214. Excellent condition. $1,800 f.o.b. Atchison. Write: Cereal Testing Laboratory, P.O. Box 60, Atchison, Kansas.

SITUATIONS OPEN

CEREAL CHEMIST: National company has opening for a cereal chemist with experience in baking technology to supervise control bakeshop and to conduct experimental work in field of baking. Salary commensurate with training and experience. Send complete resume to: Dept. 14, CEREAL SCIENCE TODAY, 1955 University Ave., St. Paul 4, Minn.

ASSISTANT FOOD PLANT SUPERINTENDENT: Large food manufacturer has an opening for a college graduate with 5 to 10 years of plant experience. Chemical Engineers and graduates with a major in chemistry will be considered. Excellent future for aggressive man to develop on the management team of a multi-department food operation. If interested, contact Mr. E. E. Morrison, Personnel Manager, Streitmann Biscuit Co., Trade & Wooster Pike, Cincinnati 27, Ohio.

Applications are invited for a Faculty position in Agricultural or Cereal Chemistry. Duties involve direction of graduate research and teaching cereal and organic chemistry. Rank and salary dependent upon qualifications. Send resume to Head, Department of Chemistry, University of Saskatchewan, Saskatoon, Saskatchewan, Canada.



NEWS AND ANNOUNCEMENTS

Sampling: The November 1960 issue of the AOAC journal contains a 73-page report on the sampling and analysis of bagged fertilizer. The space allocated to this comprehensive report testifies to the importance attached to the results obtained. While feeds were not specifically included, several parts of the report would seem to be extremely pertinent to the feed industry. Of particular interest are the chapters on the effects of order of sampling bags, variation in sampling instruments, variations by men taking samples, and comparisons of probes vs. riffles.

Some interesting data on assay precision, both inter- and intralaboratory, are presented and analyzed. Also included are manufacturing variations, both bag-to-bag and within bags. With today's emphasis on feed uniformity, this fertilizer report will be found to be very thought-provoking.

Crotolaria: The presence of seed from crotolaria species in mixed feeds has received considerable publicity recently. The weed is quite commonly found in plantings of corn, soybeans, oats, and other grains. The alkaloids in the seeds are so powerful that only a few seeds per pound of feed can elicit toxic symptoms. Detailed methods are now published for detecting crotolaria seed in feed products. These methods cover gross appearance, microscopic characteristics, and chemical tests. Write for the following new publication:

"Detection of Crotolaria Seed in Mixed Feeds," by E. E. Brown and J. F. Fudge, Misc. Publ. 474, Texas Agr. Exp. Sta., College Station, Texas; dated December 6, 1960.

Feed Moisture: The belief is commonly held that as long as grains or feeds are stored below a certain moisture content, mold growth and/or overheating will not develop. A recent study has shown, however, that both storage temperature and moisture content are important. The critical point is the interparticle humidity, which should not exceed 72%. One can easily understand why some ingredients or feeds are safe in one area, but begin to heat and mold when shipped to a warmer area. This suggests that present moisture standards for many grains may be too high in some areas. Complete details may be found in *J. Agr. Food Chem. 8:* 371.

Vitamin A Assay: Laboratories now performing spectrophotometric determinations of vitamin A activity are directed to the new USP XVI which was published recently. This gives the latest method on page 938, using the revised coefficients in the correction equation. This information was published previously in the Second Supplement to the old USP XV. The expected assay variation between laboratories, based on a USP study, is shown as ± 8%. However, it might be mentioned that any one laboratory should be able to obtain precision in the order of ± 2–3%.

ROBERT C. WORNICK

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CAKE MIXES

Base Flavors #103 and #104 add the richness of butter to dry mix blends. They stay mild and fresh for months and months and months in your dry mix package. Then—under oven heat the flavors open like flowers to the sun, sending a tantalizing appetizing aroma together with a "rich" taste that smacks of "fresh ingredients". It's *FFRP*—Base Flavor 103 or 104 that makes the eater say "M-M-M DELICIOUS!!!"

Note: Base Flavor #103 or #104 blended with lemon or orange or spice creates a mellow richness to the blend that is indefinable but "OH SO DELICIOUS"

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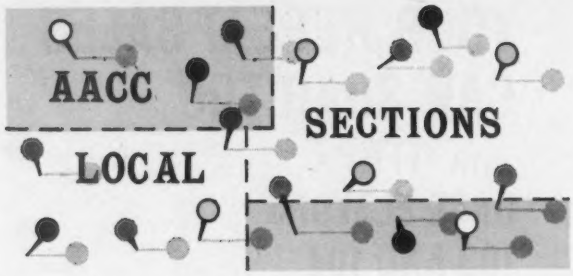

California Section met at Spenger's Fish Grotto on January 11. Speakers were Earl Cole and Irving Hunter, both of Western Regional Research Laboratory. Dr. Cole discussed work on determining total acids, carbonyls, and alcohol in pre-ferments. Mr. Hunter discussed the use of gas chromatography in detecting and indentifying individual organic acids in pre-ferments, and reported the presence of 30 and tentative identification of 180.

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Southern California Section held its February meeting on the 7th—Ladies' night. Mal Whiteford of the Borden Company showed a film on the production of milk and cheese, biscuitmaking, and the manufacture of mayonnaise. Representatives from the company's sales staff were present to answer questions about these products and other matters the ladies were interested in.

For its November meeting (on the 1st) the Section presented Sid Coyne, Coyne Chemical Co., with a talk on factors affecting the efficiency of fog spraying with contact insecticides. Mr. Coyne discussed basic information on physical characteristics of the area being sprayed, insect variables, type of insecticide formulations, and the efficiency of various types of sprayers.

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Chesapeake Section met on January 12 in the Galaxy Room, Friendship Airport, Baltimore. AACC National President John A. Johnson spoke to the group on his investigations into the browning reaction in baked products. He also brought members up to date on Association activities. Forty-five persons were present. A gavel made by Walter Davidson was presented to Chairman Edith Christensen. At the next meeting, February 23, the speaker will be Jo Ann Griffen of Chas. Pfizer & Co., Inc.

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Niagara Frontier Section's January meeting (9th) was held at the University of Buffalo. John A. Johnson, AACC National President, spoke on present knowledge concerning bread flavor.

New officers for 1961 are: Frank Wagner, chairman; Charles Bronold, vice-chairman; George Willkens, secretary; A. C. Anderson, treasurer. Executive committee: Stanley Skelskie, Norman Schack, and Henry De Oca, Jr.

New members: David MacMillian, Robin Hood Flour Mills, Port Colborne, Ont.; John Caul, International Breweries, Iroquois Division, Buffalo.

The February meeting (13th) began with dinner served in Building "C", Erie County Technical Institute. Speakers were George Parman of Hoffman-La Roche Inc., on "Nutritional supplement in the cereal and feedstuffs industries"; and Arnold Walker, Buffalo Meat Products Inc., on "The role of fish meal and meat scrap as poultry feed supplements" and "The effect of nitrogen fertilizers on the growth of grasses."

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Canadian Prairie Section met on January 24 in the Board Room of the Grain Exchange, Winnipeg. I. Hlynka of the Grain Research Laboratory spoke on the farinograph as a research instrument. He described experiments whose object was to determine the effect of variable absorption, mixing time, and temperature on dough mobility; also the effect of varying amounts of salt. Dr. Hlynka's tests showed that increasing salt does not have a tightening effect on dough, as is commonly believed.

February meeting: the 23rd.

New members: Saul Zalik, Univ. of Alberta, Edmonton; V. Bendelow, Canada Dept. of Agriculture, Winnipeg; G. Grosh, Fairway Milling Co., St. Boniface, Manitoba; M. O. Tafichuk, Univ. of Alberta; F. W. Houghen, Univ. of Manitoba, Fort Garry; J. W. Bradley, R. H. Kilborn, H. Black, and Mrs. C. Marek, all of the Grain Research Laboratory, Winnipeg; and A. Giesbrecht, Soo Line Mills Ltd., Winnipeg.

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New York Section had more than 100 members and guests in attendance at the January 10 meeting. Among them, as well as President John A. Johnson, were several members who are past presidents of the AACC. They are shown in the photo, left to right:

R. C. Sherwood, Oscar Skovholt, Clinton L. Brooke, John A. Johnson, Hugh K. Parker, and William H. Cathcart. Charles N. Frey was unavoidably absent.

The meeting on February 14 was Ladies' Night, appropriately to the date. Guest speaker was Ernest Guenther, vice president and technical director of Fritzsche Brothers, Inc. Dr. Guenther gave a short talk and showed a color film on "Essential oils of South America."

New members: Donald L. Piekunka, Atlas Powder Co.; John F. Kennedy, Extrin Foods, Inc.; Charles Becker, Sheffield Chemical Co.; Paul Ashley, Cacao Barry, Inc.; and Ralph Harvey, Ralph B. Harvey & Co.

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Toronto Section met January 6 at the Carleton Club in Toronto. AACC President John A. Johnson presented news of AACC affairs in general and of the forthcoming convention in Dallas. His formal talk was on recent developments in the analysis and identification of flour components in bread.

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Cincinnati Section's later report of its winter meeting, held in Cincinnati, January 20 and 21, brings further details on some of the talks.

John Holme of Procter & Gamble's Miami Valley Research Center discussed "Fractionation and charac-

terization of albumins and pentosans in cake flour." He described the application of ammonium sulfate precipitation and "preparative curtain" electrophoresis to the fractionation of the water-soluble constituents of bleached cake flour. The results revealed the composition of aqueous extracts in terms of albumins, pentosans, and gliadin, and the effect of such variables as solvent: flour ratio, electrolyte concentration, area concentration, mixing time, etc., on this composition. The albumin fraction was found to contain at least six components by moving-boundary electrophoresis, and was heterogeneous by ultracentrifugation. A pure pentosan fraction was obtained by zone electrophoresis and was characterized by moving-boundary electrophoresis and sedimentation studies.

J. T. Wilson ("Particle size measurement and distribution of wheat and other starches") discussed the use of a laboratory-scale air separator to determine starch particle size for various types of starches; and the use of the Coulter counter for measuring the percentage of each size of particle in a given starch.

The spring meeting was set tentatively for March 24 in Columbus, Ohio.

New members: Russell Shideler, Evans Milling Co., Indianapolis; Karl N. Gausepohl, and Robert J. Christman, The Kroger Food Foundation, Cincinnati; Elmer Reusch and Tom Bell, Liberty Cherry Co., Dayton, Ky.; John Holme, Procter & Gamble, Cincinnati; Ray Mooi, Hekman Biscuit Co., Grand Rapids, Mich.

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Northwest Section met January 24 at the Tempo Restaurant, Minneapolis. Lawrence Zeleny, U.S. Department of Agriculture, described his month-long trip through the Soviet Union, observing the growing, storage, and processing of grain as a member of the U.S. mission. He showed many interesting slides depicting typical Soviet farms, elevators, and flour mills.

AACC President John A. Johnson presented the Presidential Plaque to Past-President D. B. Pratt, Jr.

At the February meeting (24th), Irvin E. Liener, University of Minnesota, is speaker.

At the Section's October meeting (28th) in Minneapolis, plant pathologist Clyde M. Christensen discussed his latest work on grain storage and, with effective use of slides, showed tables demonstrating the germ damage and loss of vitality caused by the fungus Aspergillus ochraceus during storage when moisture content is high. With favorable conditions, an increase in moisture of 0.5% would increase germ damage by 22% in one month, he said. This emphasized the importance of accurate moisture tests; heavy financial losses due to erroneous results were cited by Dr. Christensen.

New member: Leonard Kresoya, General Mills.

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Midwest Section's symposium (January 10) on the subject of new products from corn, moderated by T. J. Schoch, was so well attended that another symposium was arranged for the February meeting (6th), on "Use of fats in bakery products" with E. Feigon of Kitchen Art Foods as moderator. Papers were on "Nutritional aspects of fats and oils as related to bakery products"—H. I. Spannuth, Wilson & Co.; "Applications of spray-dried emulsions in the baking and food industries"—Dr. Noznick, Beatrice Foods Co.; and Properties of fats as related to use in cereal products"—Mr. Woerfel, Armour & Co. It is intended to publish the papers in booklet form, so as to make the information available to cereal chemists.

DETMOLD STARCH CONGRESS

The annual Starch Congress will be held April 26–28 in Detmold, Germany. Program is listed below. Further details can be obtained from Dr. W. Kempf, Federal Cereal Institute, Am Schutzenberg 9, Detmold, Lippe, Germany.

K. Freudenberg (Germany)—Structure and form of the starch molecule and of the cycloamyloses.

M. Samec (Jugoslavia)—Colloid chemical and chromatographic contributions to the constitution of starch.

M. Ulmann and S. Augustat (Germany)—Mechanochemical decomposition of starch, amylose, and amylopectin by vibratory milling.

A. Aszalos (Austria)—Selected reactions from the chemistry of starch and sugar.

J. R. Van der Bij and W. F. Vogel (Holland)—Infrared spectroscopy of some starch derivatives.

A. H. Czaja (Germany)—Identification and location of the starch components in the starch granule and around the plastid membrane.

L. Améen (Sweden)—Corrosion problems with stainless steels.

J. Van der Dorpel (Holland)—Practical experience with hydroclones and screen bends in the starch industry.

C. F. Seyfried (Germany)—Treatment of sewage from starch factories.

E. Samal (Germany)—Fundamental concepts of control techniques.

H. F. Grave (Germany)—Electrical measurements in the starch industry.

E. Benthien (Germany)—title to be announced.

H. Runge (Germany)—title to be announced.

W. Kempf and G. Tegge (Germany)—Yield and quality problems in corn starch production.

A. Nowak (Germany)—Edible oil from corn germ.

E. Conrady (Germany)—Corn steep water as raw material for the biological synthesis of proteins.

R. Grau (Germany)—Application of hydrolyzed starches in the manufacture of meat products.

A. Holtermand (Denmark)—Application of hydrolyzing agents in glucose manufacture.

A. Guell (Spain)—Contribution on the acid hydrolysis of starch.

J. Holló and J. Szejtli (Hungary)—Effect of the type and concentration of various acids on starch hydrolysis.

K. Kroyer (Denmark)—Filtration in the glucose industry.

G. J. De Jong (Holland)—Technical and industrial aspects of the purification of starch hydrolysates by ion exchange.

O. J. Borud (Norway)—Crystallization of dextrose.

the President's Corner

news of the association

Honor has been variously defined. When we think of "honor" in relation to members in this Association, the connotation is one that implies a visible sign of our esteem for what that individual has done. The acts that lead to the presentation of this honor may vary. The basis may lie in a single outstanding accomplishment, or it may be in a pattern of accomplishments in research established over years of diligent effort. We may also honor individuals for their contributions to our world society through work in our Association. Usually, each special honor indicates the limitations or considerations for which that honor is bestowed. This year your Association will pay tribute to several of its outstanding individuals. In a small way, we will say "thank you" for a task well done.

One of the main objectives of our Association is to develop new facts and knowledge in the field of cereal technology. To encourage the individual, we offer, on occasion—not every year—the Thomas Burr Osborne Award for outstanding research accomplishments. This year your Osborne Award Committee has selected for this honor Dr. Majel M. MacMasters, who through years of persistent research effort has won the respect and esteem of all who have followed her research accomplishments in the areas of kernel structure and starch properties.

To provide encouragement and recognition for promotion of the Association objectives, your Board of Directors has established a new award. This is to be known as the William F. Geddes Memorial Award, so designated for the late Bill Geddes who worked a lifetime for the ideals of this Association. A committee, similar to that for the Osborne Award, will select the individual to be honored.

Another honor in recognition of services to the field of cereal chemistry is in the form of Honorary Membership. This year your Board of Directors has asked the Association to vote on six members for Honorary Memberships.

All this is, indeed, a small but sincere way of saying "thank you."

JOHN A. JOHNSON

Report of the AACC Representative on AAAS Council

The American Association for the Advancement of Science is the one large national-membership organization in the United States that represents all fields of science. Members include both professional scientists and laymen who share an interest in the advancement of science. Its stated purposes are to further the work of scientists; to facilitate co-operation among scientists; to improve the effectiveness of science in the promotion of human welfare; and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

The AAAS has 17 sections covering all fields of science. The AACC is affiliated through Section C, Chemistry. The 65,000 individual members of the AAAS come from every branch of the physical, biological, and social sciences and from education. Annual meetings of the AAAS are held in major cities during the week between Christmas and New Year. The 1960 meeting was held in New York City. Official registration was over 7,000.

As AACC Representative, I attended the meetings of the Council on December 27 and December 30. The Council has about 400 members, 290 of whom are representatives of affiliated organizations such as our own Association. President C. D. Leake, who presided at both meetings, asked Council members to report to their respective affiliated societies on the activities of AAAS, and to stress the advantages and importance of membership, which includes a subscription to the weekly publication, *Science*. Membership is open to anyone, scientist or layman, who has a sincere interest in the advancement of science. Annual dues are $8.50.

Dr. Leake reminded the Council that through a special arrangement with the American Academy of Arts and Sciences, their quarterly journal, *Daedalus*, is available to AAAS members at a reduced price. Similar reciprocal arrangements with other scientific organizations are under consideration.

As part of an extensive program for improved communications between scientists and laymen, it was announced that the AAAS will shortly begin publication of a quarterly News Bulletin, designed to bring information about science and scientists to the general public. An important aspect of the program will be the setting up of speakers' panels in major urban and university centers, following the example of the British Association for the Advancement of Science, which is bringing news of science to many thousands of persons through addresses by qualified scientists.

This vital work of informing the public will be assisted by the AAAS Committee on Public Understanding of Science and the Committee on Science in the Promotion of Human Welfare. It is expected that AAAS speakers will tackle such subjects as radiation hazard, problems of overpopulation, and pollution of the nation's air and water. The AAAS was founded with the idea that public enlightenment is important, and Dr. Leake urged that this be kept in mind.

I came away from the Council meetings with the conviction that AACC members may well be proud of their affiliation with that great scientific organization, the American Association for the Advancement of Science. It is my recommendation that whenever possible we send a qualified member of the AACC to represent us at the annual meeting of the Council.

CLINTON L. BROOKE

BOOK reviews

Radiation Technology in Food, Agriculture, and Biology, by Norman W. Desrosier and Henry M. Rosenstock. The Avi Publishing Company, Inc., Westport, Conn., 1960. Price $12.50. Reviewed by MAX MILNER, United Nations Children's Fund, United Nations, New York.

Since World War II, the widespread availability of radioactive isotopes and irradiation facilities has resulted in a rapid proliferation of specialized literature covering many applications of ionizing radiations. This 400-page volume by Dr. Desrosier, Professor of Food Technology at Purdue University, and Dr. Rosenstock, Senior Radiation Scientist of the William H. Johnston Laboratories Inc. and formerly of the Oak Ridge National Laboratory, was written to bring together pertinent information from the physical and biological sciences and to focus on some of the positive uses of atomic energy in the fields of food and agriculture and biology. Actually the book is much more than a practical manual of radiation technology, since it provides excellent background in the basic chemistry, physics, and biology upon which any clear understanding of radiation effects must be based.

The book has five major parts and 21 chapters. The first part, consisting of five chapters, called "Introduction to radiation and its effects," reviews the fundamental properties of matter pertinent to nuclear phenomena and radioactivity, as well as the basic chemical and physical effects produced by ionizing radiations.

Two chapters in Part II, on "Radiation source technology," deal with the kinds of sources available and with means for monitoring and measuring radiation dosages.

Part III, titled "Interaction of radiation with living organisms," deals with fundamental radiation biology. This section, comprising seven chapters, is the "meat" of the book, covering thoroughly the effects of radiations on water and solutions, as well as changes produced in organic compounds, macromolecules of biological importance, and living cells. It culminates in a critical review of current knowledge of radiation effects on plants and animals.

The final section—Part IV—called "Radiation processing technology," with seven chapters, covers the more specialized and applied aspects of food irradiation including interactions of ionizing radiations with food constituents, and the influence of such interactions on wholesomeness and acceptance. Current techniques in food irradiation, with a discussion of type of facilities employed, are presented, and probable future developments are noted. An analysis of the economics of radiation treatment for various purposes is given as well as a discussion on radiological safety measures.

Advanced students in various fields of biology will find this a most useful text. It is also of value to the food chemist and food technologist seeking to determine from a rational and fundamental viewpoint the possible application of radiation to their fields. Few specific data useful to the cereal chemist appear, except for brief information concerning insect control in wheat and flour; unfortunately this does not review the most recent research which indicates that damage to these materials can occur at dosage levels recommended for insect control.

In general the book is carefully written and well organized, although the first three sections, dealing with the fundamentals, seem to be at a higher level in this regard than the last. An excellent feature of the volume is the very extensive reference list at the end of each chapter to books which are a roll-call of the major literature in the fields of atomic theory, molecular structure, nuclear energy, ionizing radiations, and fundamental biology.

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Microscopic Analytical Methods in Food and Drug Control; Food & Drug Technical Bulletin No. 1, U.S. Dept. of Health, Education and Welfare. Price, $2.00 per copy.

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Biochemical Changes during the Prolonged Storage of Wheat under Hermetic Conditions, by V. A. Shvetsova and N. I. Sosedov; translated by D. Budd. M 1641, 12 pp., 40 refs. (60-19928). Translation of **Biokhimiya Zerna** (USSR) 1958, no. 4, p. 229. (See below for ordering.)

The Effect of Some Organic Acids on the Duration of the Vernalization Phase in Winter Wheats, by Ke-wei Tan [1960]; trans. no. 9; 12 pp., 26 refs. Translation of **Botanicheskiy Zhurnal** (USSR) 1959, vol. 44, no. 10, p. 1437. (See below for ordering.)

A Contribution to the Knowledge of the Wheats of China, by M. M. Yakabziner [1960]; translation no. 8; 16 pp., 28 refs. Trans. of **Botanicheskiy Zhurnal** (USSR) 1959, vol. 44, no. 10, p. 1425. This and the two translations above are published by **Technical Translations** and may be ordered from either of the following two agencies: Photoduplication Service, Publication Board Project, Library of Congress, Washington 25, D.C.; or SLA Translations Center, The John Crerar Library, 86 E. Randolph St., Chicago 1, Ill. Available in microfilm, price $2.40, or photocopy, price $3.30. Make check or money order payable to the agency.

TOXIC CHEMICAL AGENTS offer the greatest bargain in a weapon which can cause immediate disability and/or quick kill of any of the Chemical, Biological, and Radiological weapons with the exception of nuclear weapons with their blast and fire effects. World War I, the only war in which this weapon was used in large-scale operations, demonstrated its effectiveness and relatively low cost. As in all other weapons, scientific developments have tended to make the World War I gases obsolete.

The newest toxic chemical agents are colorless, odorless, and tasteless. The first indication of their presence may be the observation of the violent physical reaction of contaminated man and animals. Some of the effects of these toxic chemical agents on food will be presented at the Food and Drug Administration's Civil Defense Course for the food industry in Dallas, Texas, April 13-14, 1961.

Toxic chemical agents may be used as overt weapons over large areas as a portion of an all-out attack, or as covert weapons for the liquidation of selected groups of individuals. They do not destroy buildings, poison the soil, or permanently contaminate equipment. They may be used for temporary incapacitation, quick kill, or for almost any intermediate casualty conditions.

Our chief interest in them in their relation to food is that through the internal contamination of food they can be transferred into the bodies of man and animals where they can cause the same harmful effects as those caused by inhalation or skin contact. Liquid war gases on the outside of food or food packaging materials are constantly vaporizing. These vapors offer the same hazards as the original gas, plus the added danger of contact with the liquid agent.

Safety measures consist in the wearing of all-purpose masks and protective clothing; the detection and identification of the toxic agents; the decontamination of food and/or its containers, where possible; and the destruction of the food when it is necessary. These will all be considered in the presentation of this subject. While some of the basic principles apply to all toxic chemical contamination, individual defenses must often be considered in dealing with different kinds of foods and packaging materials. It is vitally important that food technicians know what procedures to apply to a particular situation. The time to acquire this knowledge is before the attack occurs, not after. Knowledge of the characteristics of the toxic chemical agents would be sufficient in many situations to save lives.

What are the effects of temperature, humidity, wind, etc. on toxic chemical agents?

Do war gases seek high, low, or level places?

These questions, and many more, will be discussed at Dallas. We cannot assume that the failure to use war gases in World War II will prevent their use in future wars. What enemy with adequate training and facilities for the protection of his own civilian and military personnel will long overlook the advantages offered by cheap, effective, and deadly toxic chemical agents in an effort to win in a war against us? The same enemy might give serious consideration to not using such a weapon if he could not deal a knockout blow because of our previous civilian preparedness.

You are cordially invited to attend the Food and Drug Administration's civil defense training course for food officials at Dallas, Texas, April 13-14, 1961, following the AACC meeting. There is no registration fee. Contact either: American Association of Cereal Chemists, 1955 University Avenue, St. Paul 4, Minnesota, or H. J. McConnell, Director, Civil Defense Training Program, BPPA, Food and Drug Administration, U. S. Department of Health, Education, and Welfare, Washington 25, D. C.

The "C" in CBR Weapons

Chemical Warfare

Ropiness In Bread

FROM PAGE 89

to prepare the medium are completely destroyed by sterilization for 30 minutes at 15 p.s.i. The normal bacterial flora present in flour is destroyed by sterilization for 15 minutes at 5 p.s.i.

Propionate does not alter the results of the tests, even when much larger amounts are present than normally found in bread.

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